E
78
.I18
T25
v.4
no.2

THE UNIVERSITY
OF MICHIGAN
MAY 14 1962
LIBRARY

TEBIWA

The Journal of the Idaho State College Museum

Pocatello, Idaho

Volume 4 1961 Number 2

Table of Contents

Nesting of the House Finch at Pocatello, Idaho.
. . . . . Victor E. Jones and Edson Fichter 1

Remarks on a Notched Fossil Bison Ischium.
. . . . . M. L. Hopkins and B. Robert Butler 10

Two Sites in the Upper McNary Reservoir.
. . . . . Douglas Osborne and Robert H. Crabtree 19

Notes on Material From a Burial Along the Snake River in Southwest Idaho.
. . . . . Ruth Gruhn 37

Editors:

Earl H. Swanson, Jr.
B. Robert Butler

The Museum, Idaho State College
Pocatello, Idaho

Subscription Rates:

Yearly, 2 numbers	$1.50
Per number	$1.00

Instructions for Authors:

Tebiwa is a semiannual journal of the Idaho State College Museum which publishes original papers in anthropology, biology, geology, paleontology, and museum methods. Papers in related fields such as regional history will also be published.

Manuscripts should be submitted to the Editor, typed double spaced with wide margins on 8½" x 11" bond paper, typed on one side only. An abstract not to exceed 300 words should accompany each paper. Footnotes should be eliminated wherever possible, with citations incorporated in the text and bibliography listed as in **American Antiquity**. Photographs should be unmounted, on glossy paper, with cutlines typed on a separate page.

Publication dates will normally be in the spring and autumn of each calendar year.

co
er
ld
cu
C
de
bl

in
19
th
at
Fi
in
be
th
al

[1] J
l
d
p
h
s
P

[2] p
U
B
9

Nesting of the House Finch at Pocatello, Idaho

By Victor E. Jones and Edson Fichter[1]

ABSTRACT

A study on the nesting of the House Finch, *Carpodacus mexicanus*, through four consecutive breeding seasons at Pocatello, Idaho, was based on 113 nests, 470 eggs, 296 nestlings, and 267 fledglings.

Nesting activity was observed from as early as March 27 to as late as August 19; maximum nesting occurred during late April and the first two to three weeks of May. Nest-building required an average of about six days, completed clutches averaged 4.5 eggs, the average incubation period was 13.3 days, and broods were in the nest an average of 17 days.

Loss of eggs exceeded that of nestlings by nearly 4:1. Fifty-seven young were fledged per 100 eggs laid. Annual differences in productivity were marked but no causal relationships were evident. Causes of total nest failures were largely unaccounted for but disturbance by humans was probably most important. The wide spread of dates on which egg-laying was begun during each nesting season may have offset the effects of weather, especially wind, as a depressant of reproductive success. Percentages of success tended to increase (1) as the breeding season progressed and (2) with the height of nests above the ground.

INTRODUCTION

The House Finch (*Carpodacus mexicanus*) is common throughout much of the Upper and Lower Sonoran life zones of western United States. In Idaho it is especially abundant in towns and cultivated areas. At Mountain Home, Elmore County, Idaho, for example, Evenden and Evenden (1944) counted 600 House Finches in 120 city blocks during one April afternoon.

The study reported here was conducted during four successive nesting seasons, beginning in 1943, on the campus of Idaho State College, then the Southern Branch of the University of Idaho, at Pocatello in Bannock County. Here the House Finch is a permanent resident although very few individuals are seen during November, December, and January. Increasing numbers usually become evident in February, and early in March the species again becomes common. The bird is also less in evidence during late summer.

THE STUDY AREA

Pocatello, with a population of 18,133 in 1940 and 28,543 in 1960, lies on both sides of the Portneuf River where the Portneuf Valley opens onto the Snake River Plain. Alameda, with a population of 2,691 in 1940 and 10,630 in 1960, adjoins Pocatello on the north. The northwesterly flowing river has cut its rather narrow valley across the Bannock Range which, in the main, consists of three roughly parallel north-south ridges. The Idaho State College campus, at the northeast edge of Pocatello, is 4,495 feet above sea level. The adjacent mountains rise from 2,300 to 2,700 feet above the campus.

Below the high ridges the sides of the valley are characterized by steeply sloping, subsidiary ridges, high, gently sloping benches and terraces, steep ravines, and the narrow valleys of small tributary streams. Low basalt cliffs form a prominent feature of the valley floor immediately upstream from Pocatello. Irrigation farming is practiced along the river and wheat fields of the dry farms are scattered on the lower slopes above the city. The college campus is on alluvial soils; rising abruptly to a height of about 200 feet above the campus at its northeast edge is Red Hill marked by exposures of Brigham quartzite.[2]

At the time of this study native vegetation of the sagebrush-grass association (mostly *Artemisia tridentata*) was in contact with much of the northeast edge of the campus. Rather extensive stands of juniper forest, the northward expression of the pinyon-juniper biome, were growing within about two miles to the east and northeast, and still do. Bordering the campus at its narrow southeast end is a cemetery with a heavy stand of trees, mostly deciduous; old residential areas meet the campus on its southwest and northwest sides; these latter conditions were essentially the same in the mid-30's as now, except that the trees were smaller.

The nesting study was confined to an area of the campus about nine acres in extent. Most of the trees were less than 25 feet in height. Other quantitative data concerning the trees were not recorded.

The weather at Pocatello can be characterized as generally mild. While blizzards are not uncommon in April, with light snows sometimes coming in early May, it is noteworthy that tabulations of "severe storms" for 1943 through 1946 (Monthly Weather Review, U.S. Dept. of Commerce, Weather Bureau, Vols. 71-74) do not

---

[1] Junior author's note: Victor E. Jones, Professor of Zoology at Idaho State College, died in August 1949. Analysis of the data he had gathered on the nesting of the House Finch and preparation of this report were undertaken at the request of his survivors. To them I am grateful for the opportunity of sharing in the effort. I am also indebted to Mr. James H. Phelps of Pocatello for access to his journal files.

[2] Description of physiographic features based largely upon Ludlum, J. C. 1943. Structure and stratigraphy of part of the Bannock Range, Idaho. Bull. Geol. Soc. America, 54 (7): 973-986.

include any entries from Pocatello. Maximum wind velocities never exceeded 40 MPH during those years. It should be noted that the Weather Bureau station is located at the airport about six and one-half miles northwest of the study area and that frequently short term climatic conditions are somewhat different at the two sites. Annual precipitation from 1899 to 1946, inclusive, averaged 13.41 inches; the average annual temperature for the same period was 48.0° F.

METHODS

Nests were usually visited before 8:00 A.M., during the noon hour, and again in the late afternoon. This routine was followed at least five days a week, the weather permitting. A mirror mounted on a pole was used to see into many of the nests; climbing a ladder was necessary in some instances. The height of a nest above the ground was estimated by knowing the length of the mirror pole and the limit of the investigator's reach.

CHRONOLOGY OF THE NESTING PROCESS

With Notes on Behavior

In three of the four consecutive years, 1943 to 1946, inclusive, House Finches began building their open nests early in April (Table 1). Only one nest was known to have been started earlier than April — on March 27, 1944; however, egg-laying did not begin in this nest until April 12. The next earliest starting date for nest construction in that year was April 5.

Several mated pairs were observed frequenting what later proved to be nesting sites for several days before nest-building began. One pair apparently roosted in the chosen nest tree for eight nights before they started to build.

The time involved in construction was recorded for 99 nests. Of these, 22 required four days per nest and 25 required five days, i.e., 47 per cent were built in four to five days; 17 nests were built in three days and 11 required six days, so that 76 per cent were built in three to six days; 92 per cent were built in two to eight days. The average time required for building a nest was about six days. One nest was built over a period of 22 days, but this performance is considered aberrant and is not included in the computations.

The male House Finch helps in gathering nest material but apparently only the female builds the nest. Although the male will gather material by himself while the female works on the nest, males frequently and sometimes closely accompany their mates on their trips after materials. Four males were recorded as singing much or all of the time while on such trips, and one male consistently failed to get building material to the nest because his singing interfered.

Material for nest construction is largely gathered on the ground. One pair collected their material within 30 feet of the nesting site. On two occasions, nest-building pairs secured material from old House Finch nests, one of the new nests being built about a foot below the old one. In two instances, new nests were never used but torn apart as soon as completed, apparently by the birds that built them, and the materials used at other sites. One female finch was seen taking nest material from a robin's nest.

Egg-laying did not begin in most of the nests immediately upon their apparent completion. Of 92 nests on which records of idleness were secured, 29 per cent were idle one day, 63 per cent were idle from one to four days, and 82 per cent were idle from one to 14 days; only 13 per cent were in use less than one day following completion. The remaining five per cent were idle from 19 to 34 days; whether they represent unusually long delays in egg-laying or abandoned nests that were later "discovered" is not known.

In three of the four spring nesting cycles observed, egg laying began about the middle of April, but in 1945 was initiated on April 23 (Table 1). This apparent delay may have been occasioned by a blizzard on April 11 and 12.

While it appears that, in some years at least, a minority of the breeding pairs studied undertook production of second broods, nesting did extend into July in all four years and into early August in three of the years; last dates on which eggs were laid varied from July 16 to 24.

Clutches apparently completed totaled 105 (Table 2). Although clutches varied from one (in one instance) to six eggs, 33 per cent contained four eggs and 53 per cent contained five eggs, so that 86 percent of the clutches had either four or five eggs. Average clutch size was 4.5 eggs.

The number of days to complete a clutch was usually equal to the number of eggs in the clutch. There was no instance of a House Finch laying more than one egg every 24 hours, but completion of two clutches (out of 96 for which data are available) required days in excess of the number of eggs: one of five eggs required seven days, another of four eggs required five days.

Incubation periods, as observed for 69 clutches, varied from 12 to 15 days and averaged 13.3 days. In three nests, however, hatching took place over a period of two days and two broods required three days to leave the eggs; in these instances, the outside number of days is arbitrarily considered the period of incubation. Of the

69 periods of incubation recorded, 68 per cent were of 13 days duration and 94 per cent ended in 13 or 14 days.

Some abnormal incubation patterns were observed. Two clutches which failed to hatch were both incubated for 20 days. In one of these instances, a second setting of four eggs was laid while the three unhatched eggs of the first clutch were still in the nest.

Several females were heard chirping while incubating; one could be heard a city block away. One male was seen feeding his mate while she was on the eggs.

Hatching began on April 27 in 1944 and 1946, on May 2 in 1943, and on May 8 in 1945, in keeping with the dates on which egg-laying began in the respective years. If, on the basis of our data, hatching can be said to show a peak in southeastern Idaho, it occurs in the latter half of May.

The number of days that the altricial young of the House Finch were in the nest was recorded for 55 broods. This period varied from 12 to 21 days and averaged 17. One brood required two days to leave the nest, two broods required three days, and one required four days. All other broods apparently left the nest in one day.

On June 29, 1946, a breeding female House Finch was observed to move off her nest and, accompanied by her mate, fly to a nearby tree where fledglings, apparently of their first brood, were begging for food. Five eggs were in the nest; this second clutch did not hatch.

Periods of maximum nesting (i.e., nest-building, egg-laying, incubation, and brooding) were discernible (Table 1). The peaks in 1943, 1944, and 1946 occurred during late April and the first half of May and lasted from 13 to 16 days. In 1945, however, the nesting peak was not evident until the middle of May and lasted only nine days.

PRODUCTIVITY

Data expressing the extent and success of the reproductive effort are summarized in Tables 2 and 3. The essential findings are as follows:

1. The percentage of nests successful varied from 42 in 1943 to 63 in both 1944 and 1945, with a four-year average of 56.
2. The percentage of nesting attempts that fledged young varied from 48 in 1943 to 71 in 1945, with a four-year average of 60.
3. The percentage of eggs hatching ranged from 44 in 1943 to 82 in 1945, with a four-year average of 63.
4. Young fledged varied from 86 per cent in 1946 to 94 per cent in both 1943 and 1944, with a four-year average of 90 per cent.
5. Production success expressed as the number of fledglings per 100 eggs laid, was lowest in 1943 at 41, highest in 1945 at 73; the four-year average was 57.

Errington, having recalled (1942:166) that "many passerine birds respond to nest failures by laying another clutch of eggs," later (1946:169) stated: "Taking percentages of eggs producing young as a criterion of reproductive success . . . is by no means wholly defensible." To allow comparison of reproductive success levels of two or more species or of a given species from time to time and from place to place, both Young (1949:43) and Fichter (1959) have called for standardization in terms of the egg as the irreducible unit of reproductive effort. Young (loc. cit.) believes that "the per cent of eggs producing fledglings . . . shows what per cent of the reproductive potential is attained." Fichter (loc. cit.) has, in addition, emphasized that a given natality value, by virtue of different ratio expressions, may and should serve quite different and equally legitimate objectives of life history studies.

In light of the above review, it seems appropriate at this point to make clear the rationale for much of the following discussion. The number of breeding pairs of House Finches involved in our observations (Table 1), estimated on the basis of the maximum number of nests simultaneously under construction and being used each year, is known only approximately; reproductive success cannot, therefore, be expressed relative to the size of the breeding population. The data gathered shed little or no light on the extent of renesting; even Errington (1942:167) admits "technical obstacles to tracing renestings in multiple-brood small birds." Any effort to compare our findings with those of many other workers is influenced by the frequent use in the literature of the percentage of eggs producing fledglings as a criterion of reproductive success. Finally, we are in agreement with Young (loc. cit.) to the extent that a success value in ratio to the number of eggs laid appears to most closely quantify the productivity of an avian species relative to its physiological potential.

Nice (1957) has summarized nesting success values of altricial species that build open nests as measured in 35 studies in the North Temperate Zone over a period of about 40 years. Nest success, measured in 24 studies involving 7,788 nests, ranged from 38 to 77 per cent and averaged 49. The percentage of eggs hatched, as determined by 26 studies involving 21,040 eggs,

ranged from 46 to 78, averaging 60. In 29 studies involving 21,951 eggs, fledging success ranged from 22 to 71 per cent, and averaged 46. It is notable that compared with these average success ratios, hatching success of the House Finch for a four-year period at Pocatello was five per cent higher, nest success was 14 per cent higher, and fledging success was 24 per cent higher.

Comparison of our findings with those afforded by two other studies of the House Finch (Table 4) shows marked conformity of the definitive success value (fledglings per 100 eggs laid based on total attempted production) as measured at Denver and Pocatello, viz., 59 and 57, respectively, but a considerable discrepancy between these figures and the 45 fledglings per 100 eggs found at Sacramento. It is notable that, despite the nonconformity of the fledging levels revealed by the California and Idaho studies, the percentages of eggs hatched, based on all eggs laid, were identical (63). Inasmuch as hatching success determined only for successful nests averaged 30 per cent higher in Idaho, it is suggested that values based on performance in successful nests exclusively prejudices data in favor of the nest or the nesting attempt, neither of which is the fundamental unit of reproductive effort. Success values based on total attempted production, i.e., all eggs laid (in nests, of course), are more instructive concerning an avian species' natality as an expression of its physiological potential in relation to environmental resistance, than those based exclusively on successful nests which, at best, represent only part (60 per cent in this study) of attempted production. Variations in clutch size alone would seem to obviate all bases other than the egg for a universally comparable expression of productivity.

While egg losses were the same on the California and Idaho study areas, nestling losses were nearly three times greater on the former. Differences in predation pressure by cats (Evenden 1957:116) may have been largely accountable. Perhaps more important is the fact that in both instances the percentage of eggs lost exceeded that of nestlings lost — by 28 per cent at Sacramento, by 270 per cent at Pocatello. Although the magnitude of this discrepancy was variable from year to year during the four-year study at Pocatello, the pattern dictated by preponderant losses during the egg stage was consistent and may, therefore, be of some significance. This relationship is in agreement with that shown by average values in the summary prepared by Nice (1957: 306-307) bringing together data from 26 studies on open nesting, altricial birds — 40 per cent of 21,040 eggs lost, 23 percent of 12,572 nestlings lost.

Since reproductive success is an expression of a species' effectiveness in overcoming environmental resistance during the breeding process, and since the two phases that characterize the pre-fledging development of altricial birds at a fixed location (i.e., in the nest) are quite different, frequent, albeit variable, differentials in percentage losses suffered by the two phases suggest "phasic differences in vunerability" to the effects of environmental resistance (see Table 7), assuming, of course, that environmental forces and/or factors of security remain relatively constant during a given nesting cycle (Fichter, 1959:445). That a "compensatory interaction" may be operative when "low egg survival" is followed by "high nestling survival", or vice versa (Kendeigh, 1942:26), has been suggested by Young (1949: 43), who found that, among "at least 15 species" of birds at Madison, Wisconsin, those species "having the poorest success in hatching eggs generally had a proportionately greater success in fledging their young."

Errington (1946:170) has found evidence that a relatively high egg loss from predation may be compensated for by a relatively low nestling loss, apparently due to the lowered density of nestlings and their consequently reduced vunerability to predation. On the study area reported here predation seemed to be a negligible force and the density of House Finches (at most, nine or ten pairs of breeding birds on nine acres) does not suggest a crowded habitat and thus an "exposed" population. Two questions thereby confront us: are the egg-nestling loss ratios we have found indeed "intercompensatory trends" (Errington, loc. cit.), and if so, what are the causal relationships?

It might logically be argued that higher egg losses would result in fewer nestlings per breeding pair, allowing for lessened competition in the nest (Emlen, 1942:151) and consequently higher ratios of nestling survival. However, of 41 completed clutches suffering some degree of failure at Pocatello, 78 per cent were total losses so that brood size was generally little affected by failures during the egg stage; the nine broods that were decreased in size by egg losses showed an average reduction of 32 per cent. Conceivably, competition could be the critical relationship in the compensatory response postulated here, but competition in terms of the entire species population rather than in terms of each brood separately.

Compensation also appears to be effected by increases in success percentages as the breeding season progresses — as regards both nests (Howell, 1942; Stokes, 1950) and nesting attempts (Table 5). Although in the case of the House Finch at Pocatello, higher percentages of success later in the season may have represented a density-independent response to such environmental shifts as warmer, drier weather, lower wind vel-

ocities, and particularly less disturbance by humans, some of our information suggests the operation of a compensatory response dependent upon population density. It appears that fewer pairs nested during the second cycle each year (Table 5). While those birds not nesting during mid-summer may have remained on the study area, it is possible that they moved into the surrounding countryside in the manner observed by Niedrach and Rockwell (1939: 153) who report the House Finch "leaving the cities and towns" of eastern Colorado in late summer. Whether a decrease in actual density or in the "functional" density, i.e., of breeding pairs, was in effect, the action of a density-dependent factor appears to have been a possibility.

Success in relation to elevation of the nest offers some interesting considerations, especially in view of the idea, offered by Preston and Norris (1947:270, 272), that certain species of birds "in suburban areas" are being " 'pushed' up . . . from the proper domain of bird life, viz., the ground and its immediate vicinity . . . owing to disturbance by humans and domestic animals." On the Idaho State College campus, 113 nests of the House Finch ranged from three to fifty feet above ground. The average elevation was about eleven feet; 46 per cent of the nests were built from six to ten feet above ground, 64 per cent from six to twenty feet. The percentages of nests and nesting attempts successful at different arbitrarily grouped levels show a striking gradient (Table 6). Regardless of kind of site, nests at six to ten feet elevation were twice as successful as those at three to five feet, and those ranging from eleven to fifty feet were three times as successful as the lowest group. Nests in spruce and fir trees (62 per cent of all nests) showed similar results favoring the higher nesters: nests at heights of six to fifty feet were nearly three times as successful as those from three to five feet.

LIMITING FACTORS

Of 45 total nesting failures, 42 (93 per cent) were attributable to four general causes: destruction of the nest, failure of eggs to hatch, desertion, and weather in that order of importance (Table 7). Our effort to categorize these obvious factors of environmental resistance is, of course, imperfect, evidenced, for example, by the frequency of "unaccounted" circumstances and the implication of human activity in more than one category — in fact, man was undoubtedly much more frequently involved than evidence at the nest sites would allow us to conclude. Furthermore, weather could be a subheading under "destruction." Despite these tabular weaknesses, two conditions seem to be evident: (1) Predation was negligible and (2) weather was much less important as a limiting factor than might be expected.

Certain human behavior, if clearly responsible for nesting failure, could be listed as predation. We chose, however, to reserve that category for attacks by animals other than man. One such attack may have been made by a domestic cat, but the evidence more strongly suggested a human attempt to catch an incubating finch.

Wind was apparently the most important climatic force involved in nesting failure. One nest, described in field notes as "poorly anchored," was blown down before eggs were laid in it; another newly built nest disintegrated during a wind-and-snow storm; a nest built on branches of two small elm trees growing close together was tilted during a high wind so that the eggs fell out; wind accompanied by rain destroyed another nest during incubation; and five newly hatched young were found dead beneath a nest following a night storm including wind, rain, and snow.

There is little or no evidence of a correlation between the annual differences in productivity of the House Finch as seen in this study (Table 3) and general weather conditions, e.g., monthly averages of wind velocity and temperature, minimum, maximum, and mean minimum temperatures, rain, and snow, as available in Weather Bureau records. It appears that individual storms, while responsible for some nesting failures (in about 4.5 per cent of the 113 nests observed), did not materially alter either average weather conditions or productivity of the bird.

Inadvertent disturbance by humans was very probably the prime cause of nesting failure on the college campus. The activities of students and the behavior of children using the campus as a playground appeared to subject many nesting pairs to pressure characterized as "perpetual alarms" by Preston and Norris (1947: 272). Overzealous interest by well-meaning persons apparently caused some damage and desertion; the two nests tabulated as "robbed" were probably the victims of human behavior.

Since 1946, many small conifers, mostly spruces, have been planted on the expanding campus of Idaho State College. At the same time, more and wider-ranging lawn sprinklers have been installed. Many of the small conifers, furnishing nest sites favored by the House Finch, are frequently drenched for several hours at a time during the spring and summer. It would be interesting to measure the bird's breeding density and productivity in the presence of an increased number of nesting sites under the influence of an increase in at least one limiting factor which stimulates a "natural" climatic force.

Perhaps of greater interest to the biologist than limiting factors, as such, is the behavior of organisms in relation to those factors. In this connection, the **spread** of the dates on which House Finches start their clutches (Table 1) should be noted. In view of the principle that chronologically staggered reproductive events within a population may minimize the possibility of entire crops of young being destroyed by sudden and severe, albeit transistory, enviromental shifts, the extent of the period throughout which clutches were begun (21 to 31 days for the spring nesting cycle), observed in this study, may have survival value for the House Finch.

SUMMARY

During the years 1943 to 1946, inclusive, 113 nests of the House Finch were studied on the campus of Idaho State College at Pocatello.

The finches annually began nest-building in late March or early April. Although nesting extended to late July or early August, production of second broods was attempted by a minority of the breeding pairs.

Time required for the construction of a nest ranged from three to eight days for 92 per cent of 99 nests, and averaged about six days.

Egg-laying annually began about the middle of April except in 1945 when the first egg was laid on April 23. Eggs were laid at the rate of one a day in 98 per cent of 92 clutches; 105 completed clutches varied from one to six eggs and averaged 4.5, with 86 per cent having either four or five eggs.

Incubation periods for 69 clutches varied from 12 to 15 days and averaged 13.3 days.

For 55 broods, time in the nest varied from 12 to 21 days and averaged 17.

A period of maximum nesting activity was discernible during late April and the first half of May in three of the years, during the middle of May in 1945.

The percentage of nests successful ranged from 42 in 1943 to 63 in both 1944 and 1945, with a four year average of 56. Of a total of 105 nesting attempts, 60 per cent were successful; yearly values ranged from 48 per cent (of 23 attempts) in 1943 to 71 per cent (of 21 attempts) in 1945.

Hatching success ranged from 44 per cent of 111 eggs laid in 1943 to 82 per cent of 94 eggs in 1945; of the four-year total of 470 eggs, 63 per cent hatched. Young fledged varied from 86 per cent of 101 nestlings in 1946 to 94 per cent of 49 nestlings in 1943 and of 69 nestlings in 1944; 90 per cent of the four-year total of 296 nestlings were fledged.

The egg is recognized as the basic reproductive attempt; production success per hundred eggs laid was lowest at 41 in 1943, highest at 73 in 1945, and averaged 57 for the four-year period. The four-year success value, although 24 per cent higher than the average for several species of open-nesting altricial birds, agrees closely with a five-year average for the House Finch at Denver, Colorado. Hatching success at our Idaho station was identical (63 per cent) with that measured at Sacramento, California.

Egg losses largely determined natality levels.

Different success values for eggs and nestlings suggest differences in vunerability to limiting factors and/or the operation of compensatory mechanisms. Competition in terms of the entire species population was possibly critical in the compensatory response postulated here.

Higher percentages of success later in the season suggest that a density-dependent factor may have been operative.

Height of nests above ground ranged from 3 to 50 feet and averaged about 11 feet. The percentage of nests and nesting attempts successful at three arbitrarily grouped levels shows a gradient favoring the higher nesters.

Disturbance by humans was probably the most important limiting factor. Weather was less effective than expected, with wind the chief cause of loss in this category. Predation was negligible. Causes of annual variations in success were not evident.

The wide spread of dates on which egg-laying is started may have survival value for the House Finch.

REFERENCES

Bergtold, W. H.
1913 A study of the House Finch. Auk, 30 (1): 40-73.

Emlen, J. T., Jr.
1942 Notes on a nesting colony of Western Crows. Bird-Banding, 13: 143-154.

Errington, P. L.
1942 On the analysis of productivity in populations of higher vertebrates. Jour. Wildl. Mgmt., 6 (2): 165-181.
1946 Predation and vertebrate populations. Quart. Rev. Biol., 21 (2 & 3): 144-177, 221-245.

Evenden, F. G.
1957 Observations on nesting behavior of the House Finch. Condor, 59 (2): 112-117.

Evenden, F. G., Jr. and J. R. Evenden
1944 A House Finch census at Mountain Home, Idaho. Condor, 46 (4): 209.

Fichter, E.
1959 Mourning Dove production in four Idaho orchards and some possible implications. Jour. Wildl. Mgmt., 23 (4): 438-447.

Howell, J. C.
1942 Notes on the nesting habits of the American Robin. Amer. Midl. Nat., 28 (3): 529-603.

Kendeigh, S. C.
1942 Analysis of losses in the nesting of birds. Jour. Wildl. Mgmt., 6 (1): 19-26.

Nice, M. M.
1957 Nesting success of altricial birds. Auk, 74 (3): 305-321.

Niedrach, R. J. and R. B. Rockwell
1939 The birds of Denver and mountain parks. Colo. Mus. of Nat. Hist., Popular Series No. 5. 196 pp.

Preston, F. W. and R. T. Norris
1947 Nesting heights of breeding birds. Ecology, 28 (3): 241-273.

Stokes, A. W.
1950 Breeding behavior of the Goldfinch. Wilson Bull., 62 (3): 107-127.

Young, H.
1949 A comparative study of nesting birds in a five-acre park. Wilson Bull., 61 (1): 36-47.

Table 1. Chronology of spring nesting activity among House Finches at Pocatello, Idaho.

YEAR	NEST BUILDING BEGUN[1]	EGG LAYING BEGUN[1]	SPREAD OF DATES CLUTCHES BEGUN[2]	PERIOD OF MAXIMUM NESTING[3]	NUMBER OF PAIRS
1943	April 3	April 15	21 days	April 26 - May 8	12
1944	March 27	April 12	28 days	April 29 - May 12	11
1945	April 5	April 23	31 days	May 14-22	18
1946	April 8	April 12[4]	29 days	May 1-16	18

[1] Earliest date activity observed.
[2] Spring cycle of nesting only.
[3] Nest-building, egg-laying, incubation, and brooding.
[4] On or about.

Table 2. Basic data on productivity of House Finches at Pocatello, Idaho.

	1943	1944	1945	1946	1943-46
Nests found	26	24	24	39	113
Nesting attempts	24[1]	24	21	39[2]	108[3]
Completed clutches	23	23[4]	20[5]	38	105[6]
Eggs laid	111[7]	105	94	160[8]	470
Eggs hatched	49	69	77	101	296
Young fledged	46	65	69	87	267

[1] Reliable data on fledging for 23 nesting attempts.
[2] Reliable data on fledging for 37 nesting attempts.
[3] Reliable data on fledging for 105 nesting attempts.
[4] Excludes 1 set of 3 eggs destroyed before clutch completed.
[5] Excludes 1 set of 1 egg destroyed before clutch completed.
[6] Excludes 2 uncompleted clutches totaling 4 eggs.
[7] Includes 2 eggs of an uncompleted clutch.
[8] Excludes 1 clutch of 3 eggs for which no further data gathered.

Table 3. Success ratios of various phases of the reproductive process among House Finches at Pocatello, Idaho.

	1943	1944	1945	1946	1943-46
PER CENT OF NESTS:					
With completed clutches	88	92	83	90	88
With nestlings	46	63	71	64	61
Fledging young	42	63	63	56	56
PER CENT OF NESTING ATTEMPTS FLEDGING:					
No Young	52	38	29	40	40
Young fewer than eggs laid	9	4	0	11	7
Young same as eggs laid	39	58	71	49	53
Young	48	62	71	60	60
PER CENT OF:					
Eggs hatched	44	66	82	63	63
Young fledged	94	94	90	86	90
YOUNG FLEDGED:					
Per nesting attempt	2.0	2.7	3.3	2.4	2.5
Per 100 eggs	41	62	73	54	57

Table 4. Comparison of some reproductive success values determined for House Finches at three widely separated stations.

	STATION, PERIOD AND REFERENCE				
	DENVER, COLORADO 1906-10 Bergtold (1913)	SACRAMENTO, CALIFORNIA 1950-54 Evenden (1957)		POCATELLO, IDAHO 1943-46 This study	
Based on:	All attempts	All attempts	Successful nests only	All attempts	Successful nests only
Eggs laid	283	127	110	470	284
Per cent:					
Of eggs hatched	no data	63	73	63	95
Of young fledged	no data	71*	71	90	100
Fledglings per hundred eggs	59	45	52	57	95

* It is not clear in Evenden's report whether or not unsuccessful nests involved losses of nestlings.

Table 5. Chronological distribution of successful nesting attempts among House Finches at Pocatello, Idaho, 1943 to 1946, inclusive.

	PER CENT OF SUCCESSFUL NESTING ATTEMPTS IN WHICH CLUTCHES COMPLETED IN:			
	APRIL	MAY	JUNE	JULY
	42	56	93	90
	52		92	
Number of attempts	24	57	14	10
	81		24	

Table 6. Vertical distribution of nesting success among House Finches at Pocatello, Idaho, 1943 to 1946, inclusive.

	ALL NESTING SITES			IN SPRUCE & FIR[1]		
Height above ground (ft.)	Number of nests[2]	Per cent success		Number of nests[2]	Per cent success	
3-5	26	27		18	22	
6-10	52	54		38	63	
11-20	23	70	74	12	67	65
21-50	12	92		2	50	

[1] Sixty-two per cent of all nests.
[2] Nests and nesting attempts same here.

Table 7. Causes of total failure in active nests of the House Finch at Pocatello, Idaho, 1943 to 1946, inclusive.

	NUMBER OF FAILURES DURING:				
CAUSES OF FAILURE	Nest building	Egg laying	Incubation	Brooding	All phases
DESTRUCTION					
Unaccounted	0	4	7	2	13
By humans	0	0	5	0	5
FAILURE TO HATCH					
Unaccounted	-	-	10	-	10
Infertility	-	-	1	-	1
DESERTION					
Disturbed by humans	0	1	4	0	5
Unaccounted	0	2	1	0	3
WEATHER	2	0	2	1	5
"ROBBED" (agent unknown)	0	1	1	0	2
LAWN SPRINKLER	0	0	0	1	1
TOTAL	2	8	31	4	45
PER CENT	4	18	69	9	

Remarks on a Notched Fossil Bison Ischium

by M. L. Hopkins and B. Robert Butler

This paper is concerned with a fossil *Bison* ischium of some antiquity which has been notched or grooved in such a manner as to raise the question of possible human association. The paleontological data are presented first, followed by an analysis of artifacts on the ischium. Miss Hopkins is responsible for the former and Mr. Butler for the latter.

THE PALEONTOLOGICAL DATA*

In presenting these data, fossils from two sites bordering the American Falls Reservoir in the Michaud Quadrangle must be discussed. The sites have been designated 1 and 2 on the accompanying map (Fig. 1).

Site 1

This is a small peninsula which extends out into American Falls Reservoir at the north end of the mouth of Bannock Creek. This peninsula lies in the S. E. ¼ of Section 16, T6S, R32E, Boise Meridian on the 1937 U. S. Geological Survey map of Michaud Quadrangle.

Of the two fossil *Bison* ischia to be described, the first, bearing Idaho State College Museum no. 1317, is the complete left ischium and the symphyseal part of the right ischium. This fossil was found to belong to the same animal as Idaho State College Museum no.'s 1225 and 1655 which were collected at the same time, September 1953. All three have been mended to form a fairly complete innominate of a buffalo larger than large modern male *Bison bison* and *Bison occidentalis*. See Table 1 for comparative measurements and photograph (Fig. 4) which shows only the middle portion of the pubis and the expanded anterior portion of the ilium to be missing. Had this latter part been present, there doubtless would have been considerably greater difference in the over-all size as compared with *Bison bison* if one can judge from O. P. Hay's 1914 findings when comparing the pelvis of fossil *Bison occidentalis* with that of modern *Bison bison*. Of the three comparative measurements that Hay gives (Hay 1914: 173, chart), the distance from the anterior to the middle of the acetabulum is 35 millimeters larger in *Bison occidentalis* than it is in *Bison bison*; whereas in the distance from mid-acetabulum to the rear of the ischium, *Bison occidentalis* is only 2 millimeters larger.

All three parts of the innominate from Bannock Creek peninsula were surface finds, but the fact that none of them was exposed when my paleontology class and I searched the same area the previous September shows that they must have been exposed by wave and wind erosion during the year preceding their collection.

Ischium 1317, when found, was at a distance of 374 yards out from the base of the peninsula, while the other two of the original three parts of the innominate were 81 yards farther out from the base of the peninsula.

A somewhat damaged *Bison* dentary, Idaho State College Museum no. 1308, which was also found in September 1953, was approximately 12 yards closer to the base of the peninsula than was speciman no. 1317, though whether on the line with it is unknown. Comparison of dentary no. 1308 was made with two *Bison latifrons* dentaries numbered 2986 at the Museum of Vertebrate Paleontology, University of California, Berkeley, California. Out of six comparative measurements, Idaho State College Museum no. 1308 was larger in four respects than the average of the two sides of the mandible at Berkeley. In length measurements, it was in two cases greater by 10 millimeters. In no case did it measure less than 3.6 millimeters as compared to the California specimen. V. L. Vanderhoof (1942) figured the left dentary of the Berkeley specimen and referred it to *Bison latifrons*.

Comparison was also made of Idaho State College Museum dentary no. 1308 with no. 26831 of the American Museum of Natural History, classified by Dr. G. G. Simpson (1930) as *Bison latifrons*. As compared with the American Museum specimen, Idaho State College dentary no. 1308 was larger than the American Museum specimen in two out of the three measurements obtainable on both specimens. The only notable difference is the presence of two mental foramina in the A.M.N.H. no. 26831; but until this is proved normal for *Bison latifrons*, I shall consider it an abnormality, as I have never before seen it in actual specimens or in the literature.

On this same peninsula, two additional fossils definitely identified as *Bison Gigantobison latifrons* have been found. One of these, Idaho State College Museum no. 1924, was a fairly straight craniad section of horn core measuring 527 millimeters in over-all length and 502 millimeters in maximum circumference. This horn core fragment was found partly exposed at a distance of 331 yards from the base of the peninsula in August of 1955. The second *Bison latifrons* specimen from Bannock Creek peninsula was a partial cranium with one horn core, the tip of which was incomplete. This skull was found in September of 1958 approximately 410 yards out from the base of the

peninsula, but more to the north than the previously discussed Idaho State College Museum fossils. The cranium and horn core were too disintegrated to collect, but careful exposure of them in the field enabled us to secure the following measurements according to the method outlined in Skinner and Kaisen (1947: 145). The distance dorsally from the preserved ending of the horn core to the mid-point of the skull was 1010 millimeters. This would have to be practically doubled to approximate a tip to tip measurement. The distance from the preserved end of the horn core to the upper base at the burr was greater than 880 millimeters. The average given for the latter measurement in *Bison latifrons* according to Skinner and Kaisen (1947: 205, chart) is 810 millimeters, so that there is no doubt that the uncollected specimen was *Bison latifrons*. No mature *Bison bison* skulls, jaws, or skeletal parts have ever been found on the Bannock Creek peninsula in the twenty years or more that I have collected from there. Moreover, the coloration and preservation characteristics of our innominates and dentary are indistinguishable from those of the two complete skulls, numerous horn core fragments, and a damaged cranium. The last specimen is Idaho State College Museum no. 2252 from Site 2. One of the complete skulls mentioned above, which lacked only the lower jaw, has been described elsewhere by me (Hopkins 1950).

Site 2

Site 2 is an area of the upper beach which, at the time we secured the fossils that I shall describe next, was ten yards out from, and just below, the cliff bordering the east beach of American Falls Reservoir. This site lies in the S. E. ½ of the N. E. ¼ of Section 3, T6S, R32E of the 1937 Michaud Quadrangle map. It is roughly three miles northeast of Site 1.

Site 2 is important because, on July 4, 1957, we secured from it Idaho State College Museum no. 2217, the ischial portion of a fossil *Bison* pelvis, which was even more closely associated with *Bison latifrons* skull and jaws. In a paper published in **The Journal of Mammalogy** (Hopkins 1955), I mentioned that we had found that the erosion rate of the cliff in this region averaged about 5 yards a year. The *Bison latifrons* material, as well as pelvic fragment no. 2217 from this site, had not showed at that site the year before; and the fact that some of it was completely underground and portions of it only partly exposed indicates that it was eroding out from below the surface. In general size and appearance, the ischial portion, no. 2217 from Site 2, shows no differences from the Bannock Creek peninsula specimen no. 1317 other than slight ones attributable to individual or sexual variation. Because of the slightly wider joining of the ischia at the ischial arch, 68 degrees in 2217 as compared with 61 degrees in 1317, it may be that the former is a female and the latter is a male.

Specimen 2217, the pelvic section, was about half buried when found. Just one yard up reservoir from it and between 12 and 16 inches under the beach surface, we excavated a right dentary of a *Bison*, Idaho State College Museum no. 2283; and 19 yards further up the reservoir at the same distance from the cliff, *Bison latifrons* cranium no. 2252 was found also on July 4, 1957. The *Bison* dentary from below the surface at Site 2 has all six teeth present and in good condition and is complete except for the anterior symphyseal end which is missing from a point 22.4 millimeters in front of the second premolar. That this dentary is somewhat larger than the California *Bison latifrons* specimen has been determined by the fact that it is greater than the former in four measurements, the same size in two measurements and is within a half to one millimeter smaller only in three measurements.

In comparison with the American Museum *Bison latifrons* specimen, dentary 2283 is larger in on measurement and smaller in another. A third measurement not obtainable on dentary 2283 was obtained from what is presumably the other side of the lower jaw of the same animal. This left dentary, no. 2229, is six millimeters longer in the third measurement than the American Museum *Bison latifrons* dentary and was located 13 yards from 2283 and between it and cranium 2252.

Cranium no. 2252 with the almost complete left horn core and the craniad half of the right horn core is a large *Bison latifrons* of the type referred to by Hay (1914) as *Bison regius*.

All the fossils described above from Site 2, as well as numerous others from this site in our collection, bore a limonitic stain. From charcoal (not thought to be human associated) collected from the limonitic sand and gravel matrix in which these fossils were found, the University of Michigan Radiocarbon Laboratory obtained a date of greater than 30,000 years B. P. We now know that the age of any fossil occurring in the lower gravel and sand (Bed E of Fig 3) is actually greater than 43,000 years B. P. This date was obtained from a sample of peat which we sent to the Natuurkundig Laboratorium der Rijks - Universiteit at Groningen (Netherlands). It's sample number there is GRN 3034. Although it was collected some distance inland from the American Falls Reservoir beach, the exposure from which this sample was collected contains the same strata. Both Mr. Donald E. Trimble and Mr. Andrei Isotoff (personal communications) agree that the dated peat is stratigraphically higher than Bed E.

Discussion

So little is known at present about the skele-

tal parts of *Bison latifrons* and *Bison alleni* that innominates 1317 and 2217 may eventually prove to be the latter rather than the former. If so, they may have originally come from the upper fossiliferous sand and gravel, Bed B of Figure 3, as we have in Idaho State College Museum two *Bison alleni* crania with horn cores from Bed B. In that event they would still date back to the overflow of Lake Bonneville and have an age greater than 29,700 years B. P. This date was obtained from shells from the Aberdeen terrace. I obtained the date in a personal communication from Mr. Donald D. Trimble in which he stated that he considered the Aberdeen terrace to be younger than Bed B.

The third possibility, that they may belong to *Bison bison*, seems to me to be a remote one. Not only are they larger than the large male *Bison bison* skeleton (see measurement in Table 1), but the only *Bison bison* material that I have seen in the general area appears to be quite recent. The material was located in blowouts at the top of Beed A in Figure 3.

SUMMARY AND CONCLUSIONS

In summary, it seems probable that innominates 1317 and 2217 are *Bison latifrons*, provided that they are large enough when the skeleton of that species is better known. My reasons for thinking them referrable to *Bison latifrons* are the following: (i) They appear to be *Bison latifrons* associated since lower jaws and crania of that species were found at both Sites 1 and 2; (ii) Six *Bison latifrons* skulls have been collected from Bed E from which the innominates came and from the beach area between Sites 1 and 2 inclusive; (iii) No larger innominates have been found in Bed E during the more than twenty years I have collected annually from it; (iv) No *Bison alleni* skulls have been found **in situ** from Bed E, but we have collected two of the largest and most complete *Bison latifrons* skulls in existence from that level.

AN ANALYSIS OF ARTIFACTS ON FOSSIL BISON ISCHIUM No. 1317

The ischial tuberosity of fossil *Bison* ischium no. 1317 from Site 1, described above, has been transversely notched or grooved and a hole punched into the bony protruberance below the notched area (see Fig. 4, a and b). The condition and appearance of these 'artifacts' at the time the ischium was recovered were such that Miss Hopkins did not believe them to be of recent origin. In general, the degree of surface patination or coloration of the artifacts appeared to be the same as that occurring on the remainder of the ischium, so possibly indicating similar antiquity. Consideration was given to the possibility of goring, slashing, and clawing by other animals and to 'accidental' breakage as plausible explanations of these artifacts. However, such explanations did not satisfactorily account for the relatively smooth, symmetrical appearance of the artifacts. As an alternative, the possibility of human association was suggested; this placed the problem within the purview of archaeology, and the artifacts will now be examined from that point of view.

The Notch or Groove

With reference to this artifact, a brief description of the anatomy of the ischium is a useful starting point. The ischium (*Os ischii*) forms the posterior part of the ventral wall or floor of the pelvis. In bovids, the ischium slopes somewhat downwards and inwards, but is nearly horizontal in the longitudinal direction. The ischial tuberosity (*Tuber ischii*) is the large, thick, three-sided mass at the postero-superior end of the ischium. (This is the bony eminence just below and to either side of the base of the tail.) It actually comprises three tuberosities: a lateral, a dorsal, and a ventral. In a manner of speaking, the lateral tuberosity can be viewed as the apical portion of the pyramidal *Tuber ischii*.

When the *Tuber ischii* of fossil *Bison* ischium 1317 was transversely notched, the apical portion, including the upper or superior aspects of the dorsal and ventral tuberosities, was removed. At present, the two sides of the notch meet at an obtuse angle (Fig. 4). One side is more or less horizontal and curves down over the dorsal and ventral tuberosities, exposing a broad expanse of the spongy cancellous bone on the interior of the *Tuber ischii*. This side appears to have been extensively eroded, which may have enlarged the notch and removed all indications of the manner in which the notch was initially made.

The second or vertical side of the notch (the vertical face shown in Fig. 4 c) sectioned a thick layer of dense surface bone. The central portion of this side, where it sections the surface bone, is nearly straight; the ends are evenly rounded. Unlike the opposite side, the vertical one is smooth and regular, which was one reason for considering the possibility of deliberate, controlled scoring or cutting (i.e., human association). However, there are no positive indications of scoring or cutting as such associated with this side. If this notch had been initiated by man, positive evidence of his handiwork has not survived the ravages of time.

The Hole

At one time Miss Hopkins thought that the hole might have been made by a spent bullet. With this possibility in mind, the ischium was

X-rayed at the Bannock Memorial Hospital, Pocatello, Idaho. A hypodermic needle was introduced into the hole, with the tip of the needle touching the bottom of the hole in order to clearly indicate the position of the artifact. No evidence of a bullet or other foreign body was revealed by the X-ray.

The hole is located near the distal end of the ventral tuberosity of the *Tuber ischii* (Fig. 4 b). Its orifice is about 1.0 cm. in diameter, nearly circular, and perforates the dense surface bone which is comparatively thin at this point. The chamber of the hole extends approximately 3.5 cms. into the porous cancellous bone on the interior of the ischium and is somewhat larger in diameter than the orifice. The walls of the chamber are definitely out of round, and appear to have been gouged or slightly eroded. There are no marks within nor around the hole that might be said to indicate human endeavor. The probable cause of the hole remains to be demonstrated.

CONCLUSION

Neither of the two artifacts examined is demonstrably the work of man. On the other hand, there does not appear to be any certain ground for attributing these to some other agency; hence man as a possible agency cannot be ruled out at the moment. Statistically, the significance of these artifacts is slight, but nonethe-less provocative and challenging. I should like to see more Late Pleistocene faunal remains examined with reference to possible human association, particularly where implement associations are lacking as in the instance of fossil bison ischium no. 1317. Such examination may eventually reveal a statistically significant pattern relevant to early man studies in the New World.

ADDENDUM

It has occurred to the authors that the various alternatives mentioned in the summary of the paleontological data should be examined in the light of fluorine analysis of the fossils. Such an analysis has been initiated and the results will be published at a later date.

*ACKNOWLEDGEMENTS

I am particularly appreciative of the aid provided by the following institutions and individuals: The National Science Foundation under whose grant some of the field and laboratory work was done on the Idaho State College Museum fossils; Dr. H. de Waard, Natuurkundig Laboratorium der Rijks, Universiteit Gronigen (Netherlands), for permission to use the date on the peat sample mentioned; Mr. Donald E. Trimble, United States Geological Survey, for information relative to one of the three listed radiocarbon dates; Mr. Andrei Isotoff, Chairman of Geology Department, Idaho State College, for description of Beds shown in Figure 3 and interpretations relative to the stratigraphy; Dr. Edwin H. Colbert, Chairman and Curator, and Miss Marlyn Mangus, Scientific Assistant, Department of Vertebrate Paleontology, American Museum of Natural History, for furnishing measurements of American Museum of Natural History *Bison* dentary no. 26831; and Miss Charlotte Holton, Department of Vertebrate Paleotology, University of California at Berkeley, for most of the measurements of the Idaho State College *Bison* fossils when she was my research assistant on a National Science Foundation grant. The sketches showing where the innominate bones were measured are also Miss Holton's. In addition, she also kindly furnished measurements of specimen 2986 at the Department of Paleontology at Berkeley.

BIBLIOGRAPHY

Hay, O. P.
1914 Extinct Bisons of North America. **Proceedings of the United States National Museum,** Vol. 46, pp. 161-200.

Hopkins, M. L.
1951 Bison (Gigantobison) Latifrons and Bison (Simobison) Alleni in Southeastern Idaho. **Journal of Mammalogy,** Vol. 32, No. 2, pp. 194-197.
1955 Skull of Fossil Camelid From American Falls Lake Bed Area of Idaho. **Journal of Mammalogy,** Vol. 36, No. 2, pp. 278-282.

Simpson, G. G.
1930 Addition to the Pleistocene of Florida. **Novitates of American Museum of Natural History,** No. 406, pp. 1-14.

Skinner, M. F. and O. C. Kaisen
1947 The Fossil Bison of Alaska and a Preliminary Revision of the Genus Bison. **Bulletin of American Museum of Natural History,** Vol. 89, pp. 131-244.

Vanderhoof, V. L.
1942 A Skull of Bison Latifrons From the Pleistocene of Northern California. University of California Publication, Bulletin of Department of Geological Sciences, Vol. 27, No. 1, pp. 1-24.

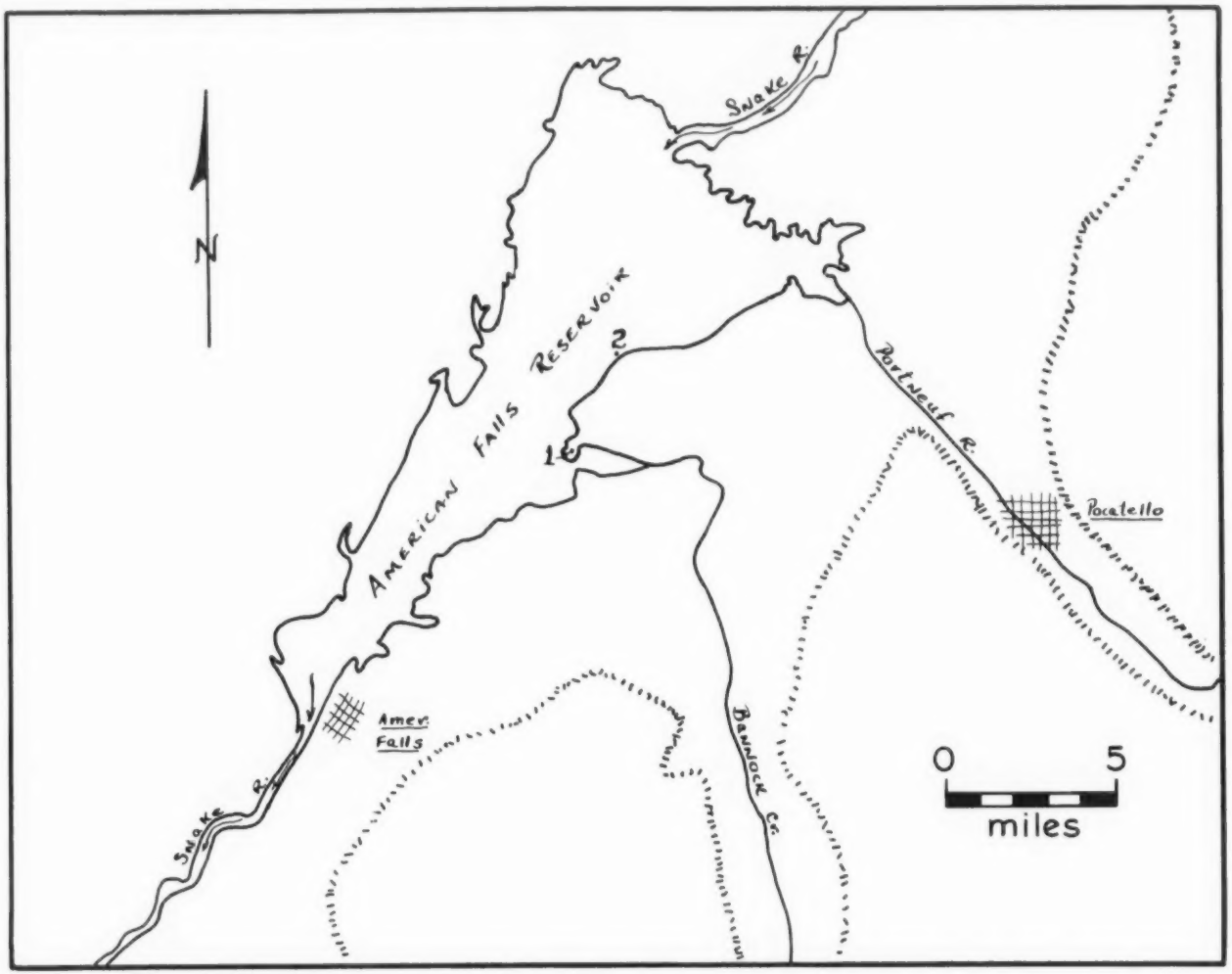


Fig. 1: Map showing location of sites 1 and 2 on the east shore of the American Falls Reservoir.

TABLE 1: Comparative innominate measurements of *Bison bison bison* and I.S.C. Museum fossil *Bison* specimen comprising nos. 1655, 1225, and 1317. See Fig. 2 for location of measurements.

Points Measured	Fig. 2	*Bison bison bison*	I.S.C. *Bison latifrons* (?) 1655, 1225, 1317 combined	No. of mm. greater of I.S.C. specimen cf. *Bison bison*
Distance from mid-acetabulum to rear of ischium	AA''-AA''	280[2]	325	45
Anterior-posterior length of acetabulum from outer rim to outer rim	A-A	82[3]	108.2	26.2
Anterior-posterior length of acetabulum from articular rim to articular rim	A'-A'	76.1[3]	94.5	18.4
Transverse diameter of acetabulum from indention ilio-ischiac surface to mid-point of pubic articular surface	B-B	69.1[3]	86.3	17.2
Transverse diameter of acetabulum articular margins from indentation ilio-ischiac surface to mid-point of pubic articular surface	B'-B'	56.1[3]	73	17
Greatest anterior-posterior length of pubic articular surface of acetabulum	C-C	49.2[1]	54	4.8
Distance from articular rim of ilio-ischiac indentation of acetabulum to medial edge of same articular surface	D-D	26.9[3]	34	7.1
Distance from articular rim of pubic articular surface of acetabulum to medial edge of same articular surface	E-E	31.2[3]	38	6.8
Distance from articular rim of iliac articular surface of acetabulum to medial edge of same articular surface	F-F	40.5[1]	54	13.5
Distance from medial edge of pubic articular surface of acetabulum to medial edge of ilio-ischiac articular surface opposite indention	G-G	28.2[1]	34	5.8
Least distance across acetabular notch	H-H	5[1]	6.6	1.6
Distance on lateral surface from lowest point of acetabulum to center of ischial spine	J-J'	84.9[1]	98.5	13.6
Breadth of iliac ramus from base of iliac acetabular fossa to base of ischial spine	K-K'	61.2[1]	75	13.8
Breadth of ischial ramus from distal end of acetabular notch to base of ischial spine	L-L'	65.7[1]	96	30.3
Least breadth laterally of ischial ramus at lesser sciatic notch	M-M'	51.2[1]	70	18.8
Least breadth laterally of iliac ramus at greater sciatic notch	N-N'	51.1[1]	63	11.9
Least medial to lateral breadth of shaft of the ilium	X-M	26.3[1]	40	13.7
Distance from posterior end of obturator foramen to posterior end (notch) of symphysis	R-V	88.1[3]	132	43.9
Distance from posterior end of obturator foramten to posterior end of tuber ischii	R-W	155.5[1]	197	41.5
Distance from center of notch at rear of symphysis to posterior end of ridge of symphysis	V-V'	53.4[1]	80.4	27
Greatest distance from anterior end of greater sciatic notch to posterior end of lesser sciatic notch	Y-Y'	260[1]	330	70
Distance from center of notch at rear of symphysis to center of first angle where ischium turns dorsally toward spine	AA''-V	87.7[1]	115	27.3
Distance from angle at rear of ischium where ischium turns dorsally toward spine to same angle opposite side	AA''-X	106.2	est. 132	25.8

[1] Male *Bison bison bison* - specimen 1555 - Museum of the Plains Indians, Browning Montana
[2] Hay - 1914: 173
[3] Male *Bison bison bison* - Museum of Natural History, Denver, Colorado

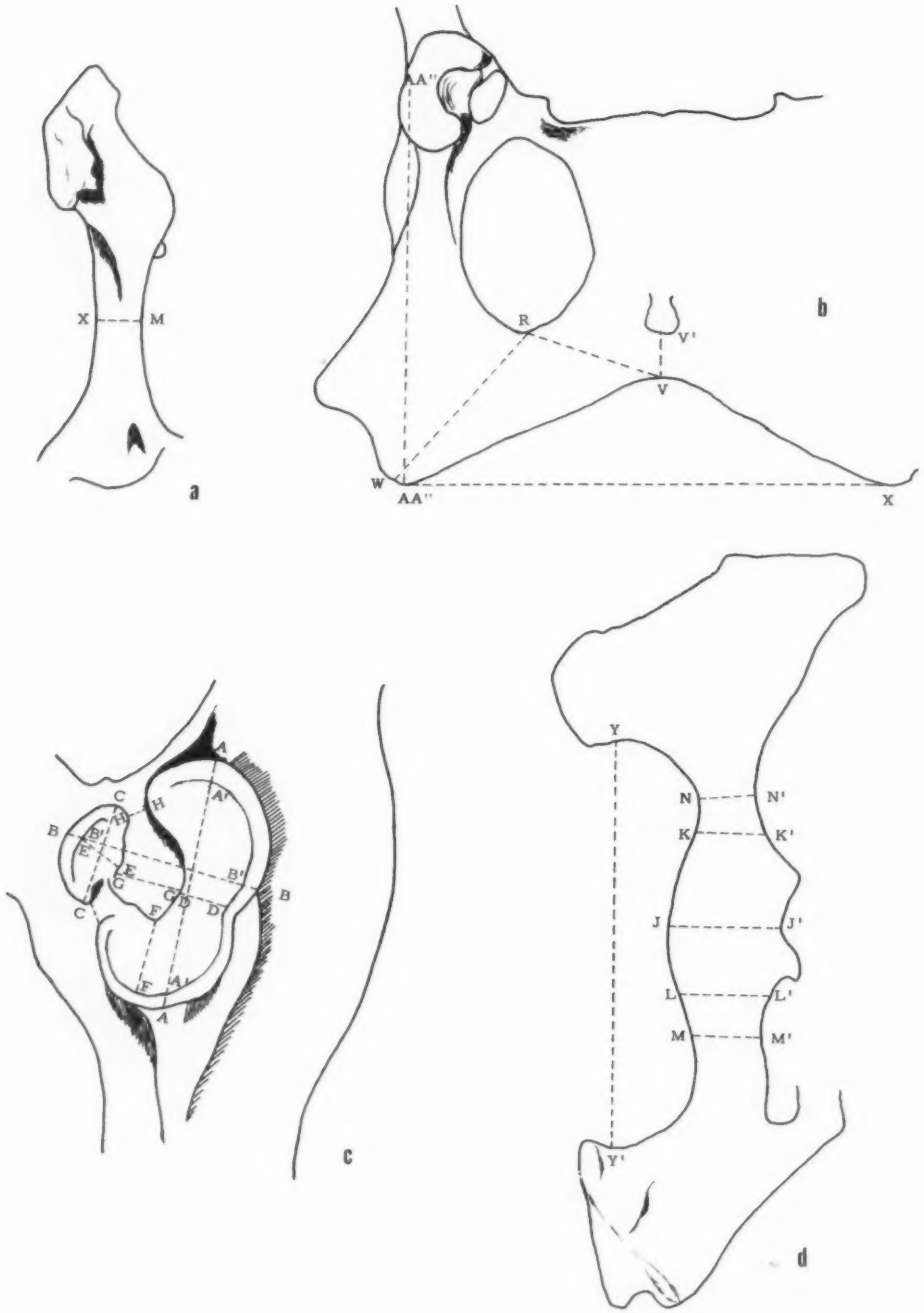


Fig. 2: Sketches showing where measurements noted in Table 1 were taken. a, ventral view of right ilium of *Bison*; b, ventral view of pelvis of *Bison*; c, ventro-lateral view of acetabular region of left innominate of *Bison*; d, lateral view of right innominate of *Bison*.

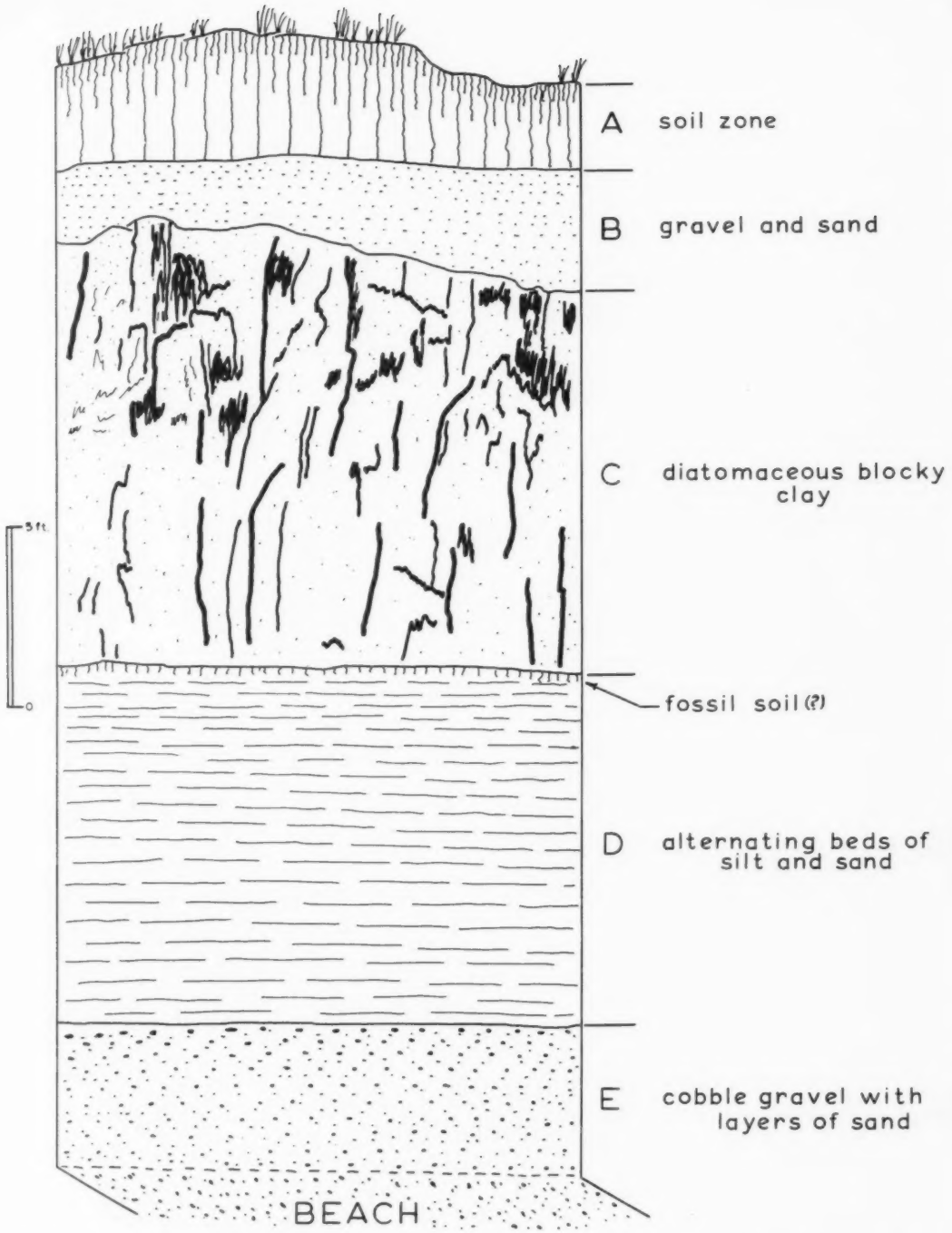


Fig. 3: Generalized stratigraphic section of cliff such as borders the beach at Site 2, based on a composite photograph of the east shore of the American Falls Reservoir between Bannock Creek and the Portneuf River (see map, Fig. 1).

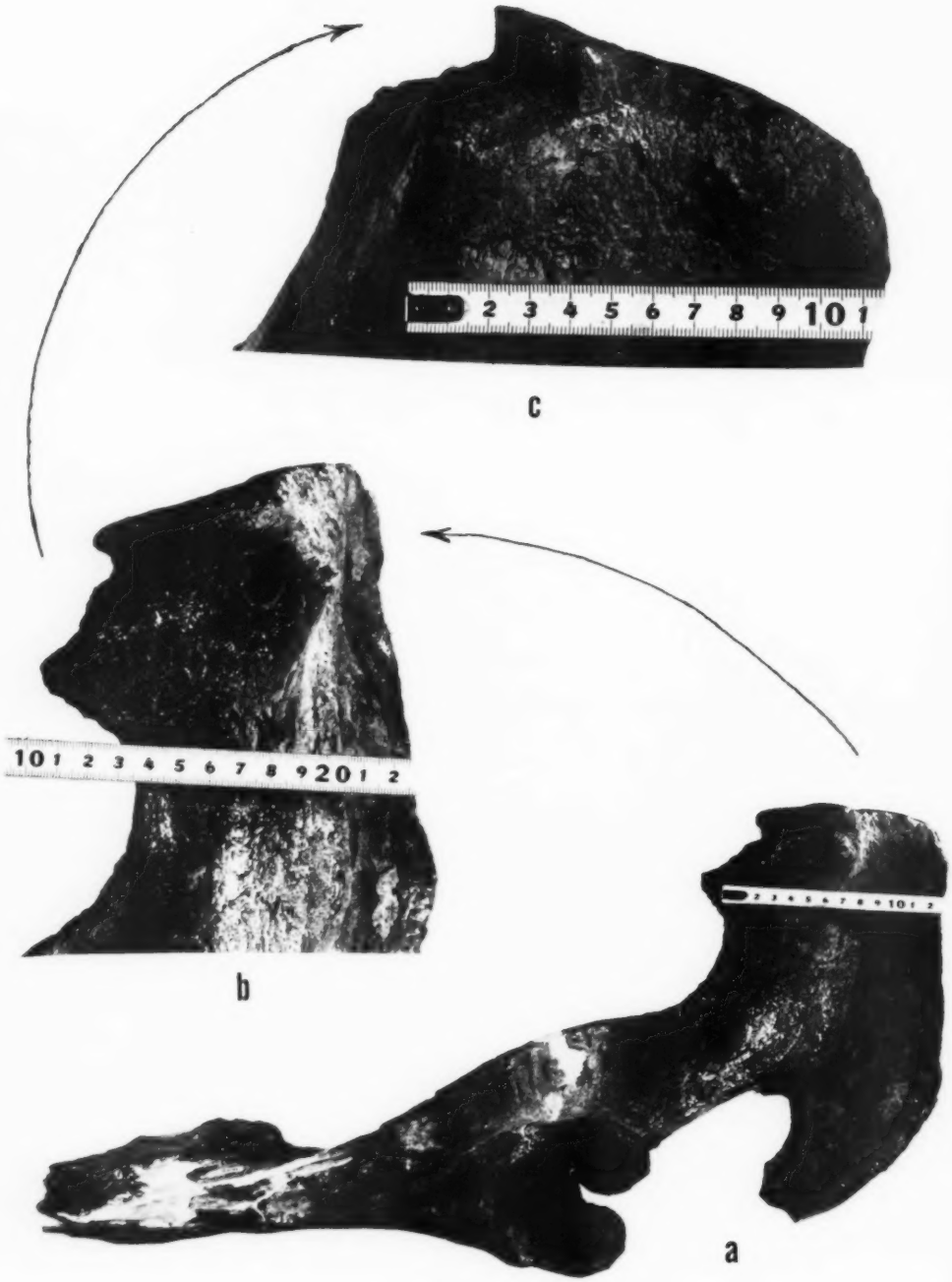


Fig. 4: Left fossil *Bison* innominate comprising ISC-M nos. 1655, 1225, and 1317. A, lateral view of assembled innominate fragments; ischium no. 1317 is the large fragment to the right of the socket. B, dorso-lateral view of the ischial tuberosity of ischium no. 1317 showing notch and hole. C, close-up profile view of notch shown in B.

Two Sites in the Upper McNary Reservoir[1]

by Douglas Osborne and Robert H. Crabtree

ABSTRACT

The paper reports limited excavations on two islands in the upper McNary Reservoir. The excavations were carried out in 1951 with the best results obtained from a very large village on Strawberry Island. The results indicate a late prehistoric community occupied repeatedly by family groups. Future scientific work may be possible, since some of the village remains above the high-water level of the McNary pool.

INTRODUCTION

On April 23, 1951 a contract was signed between the University of Washington and the National Park Service for the excavation of certain archaelogical sites in the upper end of the Army Corps of Engineers' McNary Reservoir. The sites chosen for excavation were all in the vicinity of the confluence of the Snake and Columbia Rivers - near the towns of Pasco and Kenniwick, Washington.

A crew of seven men, including the junior author who was responsible for conducting the excavations, left the University campus 15 June and arrived the same day opposite Strawberry Island, about six miles up the Snake River from its junction with the Columbia. They camped there while working 45-FR-5, a house pit site at the head of the island. During the third week in July the camp was moved to the west bank of the Columbia some eight miles south of Kenniwick. From here two other island sites were tested and partly excavated: 45-BN-16 on Goat Island and 45-BN-15 on Rabbit Island. The crew returned to Seattle during the last week of August. During the 1951-52 academic year the material excavated was processed and notes written up. Field and laboratory work were under the direction of Osborne.

Fortunately the University equipment for excavation, rather meager in some catagories, was augmented by a generous loan of a vehicle, outboard motor and other gear from the Smithsonian Institution-River Basin Survey material at Seattle. We are grateful to Dr. Frank H. H. Roberts, Jr. for permission to use this equipment. Men working on the excavation crew were from various West Coast universities. The sites were all on islands - a situation that made impossible a maximum efficiency because of the extra transportation involved. Two of the sites will be discussed in the order of their excavation. Rabbit Island (BN-15) will be reported at a later date. This paper will be confined largely to factual reporting. Neither of the authors, at the time of writing, is in a position to write comparatively or synthetically. Clearance for the publication of these data has been given by the Region 4 office of the National Park Service.

STRAWBERRY ISLAND, 45-FR-5[2]

This site is a large habitation site, or village. One hundred and thirty-one definite house pits are concentrated on the low natural levees along both sides of the head of Strawberry Island. Figure 1 is a contour map and village plan of the site. The village and contoured area include only the upper quarter of Strawberry Island. During high water now, and presumably likewise in the the past, the island was divided into two islands. A wide and fairly deep (six to eight feet) swale cuts roughly east and west across the island and divides the village area from the remainder, the downstream section. The banks cut steeply to the water on both sides of the house pit concentration but the point of the head of the island extends upstream for several hundred feet, depending upon the height of the water.

The inset, figure 1, indicates the relationship of the several sites explored in the Snake-Columbia confluence area. Darkened areas showed some concentration of cultural debris.

Figure 1, indicates little which can be sociologically interpreted at FR-5. The house pits are clustered near the edge of the water on the low natural levees, which were, nevertheless, high enough to have afforded fair drainage.

It is doubtful that the two groupings of pits, the northeasterly and the southeastern, reflect any more than the facts that houses near the water were preferred and that there was a large enough population so that both banks were used as living space. The vague clumping within the two main groups may indicate a living preference or relationships of those who dwelt in the houses. Other than this no village pattern emerges.

The physiography of the island was essentially the same in the period of occupation as it is now, except that there has been some further cutting along the north bank of the trans-island

[1] Since the preparation of this paper, there have been collected some additional data on Plateau housepits and Plateau villages. Because of the press of other obligations, the authors were unable to take advantage of the additional literature. This should be borne in mind when the paper is read. —Ed.

[2] The site designations were given by the RBS Survey of the area: F. Fenenga and C. Smith, 1947. The first symbol refers to the state of Washington, 45th in an alphabetical list of the states; FR is an abbreviation for Franklin County; 5 is a sequence find number.

swale. House pits 132 and 84 showed some evidences of erosion in 1951.

No burials or midden worthy of excavation were found on the island. The whole discussion of the site will therefore revolve around excavations in the following house pits, and a few other smaller tests:

House pits 1 and 2: by a single trench, 85 feet long, 5 feet wide, average 3 feet deep, one 5 foot square.

House pit 78: 100 feet of 5 foot trench, average 3 feet deep.

House pits 87, 189, 67, 59: One 5 foot square pit, 3-4 feet deep.

Neither time nor funds permitted more than these tests in this huge site. The information gained generally agrees with or augments that from other excavations in the McNary Reservoir (Osborne, 1957).

House Pit 1

House pit 1 was circular in shape, 54 feet long north-south and 50 feet wide East-West (fig. 6, a & b). The subterranean portion of the house was 2.5 feet deep at the center and sloped up gently to the rim on all sides. Soil stratigraphy revealed in the trench (fig. 2, profile A, sq. 30L1-29CL, sq. 22CL-21CL), shows that the loose yellow lenses of the river-laid silt have been cut and this indicates that the house extended to a length of at least 43½ feet in the N-S direction. This is shown in trench 1, horizontal plan view (fig. 2). Further evidence of this can be shown in the fact that no artifacts or culture-bearing strata were found outside this area (fig 2, trench 1, horizontal plan view). No traces remained of the superstructure either in the form of posts, planks or post holes. The saucer shape of the depression (fig. 2, A and B) conformed closely to the original floor of the house, which was visible in part as a thin lens of shell midden .8-1.0 of a foot below the surface (fig. 2, profile A and B, sq. 29L1-27L1 and 28CL-27CL). A stone hammer was found on the edge of the shell layer and a chopper was also found in it. This shell layer appears in the north end of the house pit and slopes downward, as in the case of house pit 2. Choppers, scrapers and sinkers were found in other parts of the house.

The soil level containing cultural material of house pit 1 extends down only to 1.8 feet below the surface where it covers sterile gravels. There were no intrusive pits in this river-laid gravel accumulation and there was only one period of occupancy as is evident by the one shell layer. Also there was no evidence found of a fireplace, charcoal or burned material in house pit 1. If a firepit were there it lay outside the boundaries of the trench.

House Pit 2

House pit 2 (fig. 6, a & b) gives evidence of more sharply defined stratigraphy and of several occupations. A profile of the trench is shown in figure 2, A and B. Sterile gravel was reached at 4.6 feet below the surface. The subterranean portion of the house was 1.04 feet deep at the center and sloped gently up to the rim on all sides as did house pit 1 (fig. 2). The length of the depression was 26.1 feet North-South and 38.4 feet East-West. This is of particular significance; house pits 1 and 2 are thus superficially oriented in different directions as to length and width.

The yellow lenses of river-laid silt have been cut at exactly the same spot as indicated on the surface giving the excavated length of the house at 26.1 feet, the same as the contour surface length.

From the surface to a depth of .4-.6 of a foot was the top soil or humus layer. Below this was a layer of fine, loose, wind-blown or stream-laid sand from .2-.4 of a foot thick. This layer had not been broken. Below this was a layer of light brown sand with a few lenses of darker mixed material. At 2 feet from the surface occurred the culture-bearing stratum of compact, brown mixed loamy material containing, among other items, projectile points and hammer stones. This stratum was .5 feet to 1.0 feet thick and occurred in the southern part of the house pit. Below this layer the circular, saucer shaped lens of shell occurred; it measured .3 of a foot in thickness. A thin layer of light brown sand intervened between the highly concentrated culture bearing layers above the shell lens. At each end of the first there showed a gradual transition from the dark brown loam to a light brown cleaner sand where no artifacts were found.

Below the shell layer was the second occupation level. It was characterized by rich occupational debris (charcoal and ash mixed with sand.) The greatest concentration was from 3.0 feet to 3.8 feet below the surface. The concentrated mix-level was highest in the middle of the trench and sloped slightly downward at either end. This does not conform with the other house outlines or culture-bearing layers; they all sloped upward and were saucered shape.

Throughout this last layer many scattered charcoal lenses occurred. Also mottled light yellow or brown lenses made their appearance; they resemble the loose fine yellow sand that occurs in the other levels. This is here designated as river-laid silt, presumably caused by flooding. Light beach sand was present on the layer above the sterile gravel but charcoal and mottled light brown lenses intervened in spots. Bird and deer bones were found in this fine sand and projectile

points were found both above and below the layers of yellow water-laid sand.

Summary, House Pits 1 and 2

The area in the center of house pit 2 apparently had the greatest amount of cultural material. The lower occupational level, in some parts, showed the higher concentration and gave evidence of the heavier occupation.

House pit 2 seems to have been occupied more intensively and for a longer period of time than house pit 1. Also house pit 1 probably was probably occupied later because:

1. The surface contours in house pit 1 are both deeper and larger than those of house pit 2 indicating that it has not been filled.
2. House pit 1 had the layer of shell close to the surface and little evidence of occupation. The depth from the surface to sterile gravel was only 1.4 feet at the deepest part showing that there was very little accumulation of midden.
3. There is evidence of possible back dirt in house pit 2, that was presumably thrown in as a result of excavating house pit 1 by the Indians, in the form of mottled light material near the yellow silt lenses (fig. 2, profile A, 32CL-29CL).
4. House pit 2 was occupied many times over a longer period of time than house pit 1 (or the people of house pit 1 were cleaner in their housekeeping and threw waste into the river or removed it from their pit).

It has been observed that the long axes of the two house pits vary by 90 degrees. This is puzzling because both shell layers are in the northern ends or side of the houses as if they were used in the same manner. This could be explained by the suggestion that the people of house pit 1 distorted the surface contour of house pit 2 by throwing back dirt into pit 2 while excavating their pit - a feasible explanation since the yellow silt lenses are cut exactly under the house depression.

House Pit 78

House pit 78 was chosen for excavation because it was a deep depression located on the opposite side of the island from pits 1 and 2. Also it was located in a distinctive group of house depressions as, indeed, were the other excavations.

A test pit was first dug and expansion was made when the test pit proved profitable (fig. 6, c). The results of this work can be seen in figure 3. The profile shows that there was a late fill of windblown or water-laid sand, as shown by the loose yellow sand .5-.8 feet from the surface in a consistent and uninterrupted layer, as in house pits 1 and 2. Below this layer was evidence of an occupation of some extent, and beneath this stratum were a few additional scattered traces of occupation. The first culture-bearing stratum ended at 3.5 feet below surface where a definite floor is indicated by a change in color and by packed earth. A fireplace was located in the center of this area, and also in the center of the surface contour depression. This fireplace was approximately mid-distance from where the yellow sand lenses were cut, in their natural stratigraphy, when the pit was dug, (fig. 3, horizontal plan view, and profiles E, F, G and I). There were also many fragments of charcoal and lenses of charcoal around the fireplace and in the first culture-bearing stratum.

Below this was a second stratum characterized by light brown sand with charcoal lenses occurring at different levels. A disconformity lies between this stratum and the first at 19CL (fig. 3, profile F; fig. 6, B). Had we been able to excavate the whole pit, by horizontal sectioning, we should presumably have found the reason for this break in the profile.

A third possible stratum and even earlier house pit occupation occurs beneath a yellow sand lens as shown in profile I of figure 3. It contained a circular fire pit with a polished bone comb handle associated with it (fig. 3, profile I and the horizontal plan view; fig. 7, B, 78/7). This fire pit is 4.3 feet from the surface and 5.5 feet away from the center of the house depression and the uppermost hearth; it is obviously much earlier in time.

A possible pit can be seen in 19CL and 18CL (fig. 3, profile F) where the loose yellow silt lenses have been cut. This pit, intruded into the sterile yellow sand, did not reval any evidence of cultural material.

House Pit 87

A five-foot test pit was dug in house pit 87. This pit was located in the extreme southwest corner of the site and in a separate sub-group of depressions. The stratigraphy revealed a similar pattern, one typical of that of all the house pits that were excavated.

The humus layer there extends from the surface to .15 of a foot. Below this is a layer of loose, fine, yellow sand extending .2 feet from the humus layer. There is a yellow clay-sand layer from .35 feet to .7 feet below the surface; this contained a pit .8 feet in diameter which can be disregarded as a rodent hole. There was also a circular charcoal area 1.3 feet from the surface in this yellow clay-sand layer. This charcoal pit ended at .7 feet below the surface, but mottled, dark sand began in the northeast corner at the same level, .7 feet below the surface.

The dark mottled sand that first appeared in the northeast corner proved to be part of the

upper midden stratum. It extended from .7 feet to 2.5 feet below the surface (fig. 4), and contained a high concentration of cultural material. A large, angular stone, .6 feet by .4 feet with one surface ground flat, was found at 1.6 feet below the surface in the northwest corner; it presumably was used as a grinding stone. Another large flat stone with pecked marks on the flat surface apparently a freshly sharpened grinding slab, was found about .9 feet to 1.1 feet below the wind-blown sand layer. A chopper was found at 2.3 feet below the surface in the northwest corner. At the bottom of this stratum there was a concentration of cut and broken animal bones, flakes and large cracked pebbles with a small animal horn located between 1.2 feet to 2.0 feet from the surface. Also there is one charcoal or fire pit in this first stratum in the southeast corner beginning at the yellow clay-sand and ending at 1.7 feet below the surface. A whole projectile point, a tip of a broken projectile point, animal bones, and flakes were found in the charcoal pit at 1.3 feet from the surface located in the southeast corner of the test pit (fig. 4).

The next stratum extends from 2.5 feet to sterile gravel at 3.38 feet from the surface. It is characterized by a moderately yellow sandy loam, and has many thin lenses of charcoal, like the second stratum in house pits 2 and 78. These charcoal lenses suggest that the older camps were of a short duration while the upper stratum charcoal pits were apparently used for a longer period.

Examples of the material noted and stratigraphy of the second stratum were as follows: a charcoal layer beginning at 2.2 feet to 2.4 feet below the surface contained cut and broken animal bones found at 2.7 feet below the surface associated with broken, charred rock. There was a concentration of cut, long animal bones and rocks at 3.1 feet to 3.3 feet below the surface in the southeast corner. A deer mandible, rib bones, and cut animal bones were found at 3.15 feet below the surface in the northeast corner.

The end of the excavation occurred at 3.3 feet below the surface at sterile gravel sub-soil. No pits were indicated in the gravel.

Summary, Structure and Stratigraphy

The test pit in the center of house pit 87 revealed stratigraphy similar to that seen in pits 2 and 78. All have the fine, loose, yellow sand under the humus layer followed by two culture-containing strata. The top stratum seems to have more concentration of material with thicker charcoal pits while the lower is less concentrated, but has more scattered charcoal lenses. It is composed of a darker sandy mix while the lower is of a moderately yellow sand.

The upper straum may readily be interpreted as representing the longer occupational period. The lower stratum appears to be the result of more temporary camping. An extensive excavation program would have been necessary in order to establish the cultural differences, if any, that may have existed between the two components that were revealed by our tests.

Most of the interpretation has been covered in other parts of this paper. All of the groups of house depressions in which we excavated seemed to have similar stratigraphic sequences. House pit 2 as representative of the west-center group, house pit 78 as representative of the east-center group, and house pit 87 representing the southwest group all have a stratigraphic sequence as follows: 1. humus, 2. loose, yellow sand, 3. an upper midden stratum characterized by a single charcoal pit and a heavy concentration of occupation material, 4. a lower stratum characterized by many scattered charcoal lenses with a small amount of occupation material, and 5. the subsoil of sterile river-laid gravel and boulders.

House pit 1 had only one stratum with neither fire pits nor charcoal material, and very little occupational debris. This latter was close to the surface, and the surface contour was deep. An obvious interpretation is that the pit was made and occupied briefly at a later period than were the other tested pits.

House pits 89 and 67 were tested each with a 5 foot square test pit to sterile gravel. House pit 67 was dug to subsoil at 3 feet below surface and revealed no artifacts, charcoal pits or lenses, or any indication of structures or habitation. Its shape had suggested a recent mat lodge to us and hence the test. It probably was not a house pit. House pit 89 revealed traces of habitation only in the form of a darker layer visible on the west wall. It was presumably used for a short time before abandonment.

House pit 59 was tested in a similar manner by a 5-foot test pit, and revealed a stratigraphic sequence similar to house pits 2, 78 and 87 with cultural material such as bones, charcoal and flakes found in relative abundance from 1 to 3 feet below the surface. A fire pit was clearly visible on the west wall and evidence of at least two short occupations were revealed in the stratigraphy.

The houses revealed no evidence of a superstructure; possibly because the Indians so valued the material used that they carried it (poles, mats, etc.) with them or piled it on the island for future use. Lewis and Clark indicated that this occurred as they observed the Indian habitations while traveling down the Snake and Columbia Rivers in 1805 **(see Osborne 1957, p. 189 for discussion).**

Mat houses with a shallow pit were probably the type used on the Strawberry Island site. If true, deep pit houses were used in the area, they would have consisted of a deep pit over which was erected a structure of slanting rafters, interlocked at the top or supported by center posts, covered with earth. Such dwelling would have had either a side entrance or have been entered through the roof. None of the pits tested or excavated at FR-5 were of this type nor do any of the other pits appear to be the remains of such structures.

The Pit Village

Each house pit was measured for north-south, east-west diameters and depth during the process of mapmaking. The following tabulation and discussion is a presentation of the analysis of the data thus gained. It is, too, an attempt to outline the local Indians' conventions as to size and shape of the semi-subterranean parts of their houses and to carry the data somewhat farther afield - from the comparative points of view. These data may be looked upon as an extension of the more detailed presentation appearing in **Osborne, 1957, p. 10 seq.**

TABLE 1. House Pit Measurements

	N-S Diam.	E-W Diam.	Depth	Diff. of Diams.	% of Diff.
Range	15'-54'	15.7'-50'	0.3'-2.9'	0.0-18.4'	0.0%-48%
Mean	27.05	26.43	1.09'	2.4'	11.26%
Average	27.48	26.7	1.07	....	....

House Pits

Measurements for depth and diameters, east-west and north-south, were taken for all 131 house pits.[3] Seventy-four (56.9%) of the pits were found to be larger in the north-south diameter, fifty-four (41.5%) were larger in the east-west and two (1.5%) were equal. One pit could not be measured. In the N-S measurement the greatest number runs between 22 feet and 28 feet with 26 feet being the most common single measurement, secondary peaks occur at 28 feet and 30 feet (Table 1 and fig. 5). In the east-west diameter, the greatest number lie between 21 and 27 feet, with the most common single measurement being 21 feet, and with a secondary peak at 27 feet. The greatest number, in the depth measurement, occur from 0.7 feet to 1.1 feet, the most numerous single depth being 0.8 feet, with secondary peaks at 1.1 and 1.5 feet. Thus, as can be seen from Table 1 and fig. 5, the mean depression at 45-FR-5 measured 27 feet, N-S, 26.4 e-w and 1.08 feet deep. Twenty (15% of the 131 pits here are more than 20% larger in on direction; that is, are oval in shape. The majority (57%) has a difference of less than 8%. Expressed in terms of absolute measurement, 67, or 51.5% of the house pits had a difference of less than 2 feet between the two measurements of diameter, the mean difference is 3.4 feet, or 11.2% is the mean percentage of difference between the two measurements. The range of the difference in the diameter is from 0.0 feet to 18.4 feet or 0.0% to 48%.

From the above description and a glance at the graphs and tables, one can see that the depressions at 45-FR-5 tend to be nearly circular. The depth of the depression seems to have a rough correlation with the diameter, in that the deeper depressions are also the larger. The house depressions at this site can be grouped into three areas, as can be seen from fig. 1. An attempt was made to see if the smaller areas presented a significant difference from the site as a whole. The results were inconclusive, except in the case of the pits grouped on the eastern part of the site (the left bank of the island) where the number of depressions having a greater north-south measurement, is equal to those having a greater east-west diameter. This is in contrast to the site as a whole, where, as has been noted before, the north-south diameter is the larger in the majority of pits. Testing in each area yielded meager results, and showed no striking differences, in either artifacts or stratigraphy.

While the Strawberry Island house pits generally have a greater north-south diameter, this is not the case in some other Plateau village sites. In ttwo other McNary Reservoir sites, 45-BN-53 and 45-BN-6, the majority of house pits has a larger east-west diameter, in the case of BN-53 70% of the 182 pits had a greater east-west diameter. **(Osborne, 1957, p. 10 seq.)** Site 45-BN-6 was originally excavated in 1950 (**Shiner, 1952**) and at that time 60 house pits were visible. Unfortunately the measurements of the house pits are missing from the field notes. The site was revisited in July, 1951 by Osborne and a small crew to retake the measurements. It was found that slightly more than one-half of the original 60 pits had been eroded away by the river since 1950 and east-west measurements could be taken for only 29 pits, north-south measurements for only 26. Twenty-two of 26 measured house pits are longer in the east-west diameter. In the Chief Joseph Reservoir 17 of the 28 pits measured had the east-west axis as the larger. **(Osborne, et. al., 1952, p. 371.)** The significance of this is that in all cases where measurements are available, the house pits were oriented with the river or lake that lay nearby. This accounts for the situation at 45-FR-5 where the Snake River is running almost

[3] Originally, there were 132 HP's measured, but on testing H. P. 67, thought to be a mat house depression, it was found not be be a house pit. It is retained on fig. 1 in order to show the location of all tests.

due north and south. At the other sites mentioned, the Columbia runs roughly east-west. At sites 45-GR-27 and FR30, on Moses Lake, the oval houses had their long axes oriented parallel with the lake shore. **(Daugherty, 1952).**

In terms of gross size the house depressions of 45-FR-5 are larger in range and mean of diameters than the house pits measured for 45-BN-53 and BN-6 in the lower McNary Reservoir. The range north-south diameter at 45-FR-5 is 15 feet-54 feet, whereas it is 7 feet-44 feet at BN-53 and 6.5 feet-26.0 feet at BN-6; the mean north-south diameter at FR-5 is 27.06 feet, at BN-53 16 feet, and at BN-6 13.6 feet. For the east-west diameter, a similar situation prevails: at FR-5 the range is 15.7 feet-50.0 feet with a mean of 26.4 feet, at BN-53 9.0 feet-38.0 feet with an average of 19 feet, and at BN-6 it is 7.7 feet-31.4 feet with a mean of 16.5 feet. Data for the average or mean depths of these three sites reflect a somewhat different situation. At FR-5 the mean depth is 1.08 feet, at BN-6 0.93 feet, and at BN-53 the average depth is 0.76 feet. The ranges of depth from these three sites fall within the range of the house pits at FR-5. **(Osborne, 1957, p. 10 seq.).** The situation for the Chief Joseph Reservoir pits seems to be not too dissimilar from that of 45-FR-5. The ranges are wider due to the inclusion of some small depressions which have a doubtful status as house pits. The north-south range is 3.5 feet-50.0 feet with an average of 22.9 feet; the east-west is 2.6 feet-60.O feet with an average of 24.9 feet. The depth ranges from 0.8 feet-4.7 feet with an average of 1.9 feet. **(Osborne, et. al., 1952, p. 372.)** With the data given above it is apparent that the depressions at 45-FR-5 represent a somewhat different tradition in house types, as far as gross size is concerned. The pits observed in the lower McNary Reservoir at 45-BN-6 and BN-53 were consistently smaller in both diameters. The differences between those two sites are not as great as those between BN-53 and FR-5. The ranges of diameters from both of the lower McNary sites are to a large extent the same, although the depressions at BN-6 are consistently smaller, having a much narrower range than those at BN-53. This may be due in part to the fact that the series from BN-53 is slightly more than four times the size of that from BN-6. As would be expected the series from FR-5, to a large extent, overlaps the two from lower McNary, but the minimum diameters from BN-53 and -6 are much lower than those from Strawberry Island; also, the maximum diameters show the same disparity. The material from the Chief Joseph Reservoir shows a much closer correlation with the FR-5 material than with the lower McNary data. The ranges of the Chief Joseph house pits are wider, as has been pointed out, and probably include a number of depressions not used for habitation purposes. They may have been the remains of sweat lodges or menstrual huts and it has been suggested by Osborne that the smaller depressions may have been houses of older or single people (1957, p. 25). Whatever the functions of the smaller depressions might have been, the average depression in the Chief Joseph Reservoir is only slightly smaller than the average Strawberry Island house pit. It should be noted, however, that the average depression at Chief Joseph is also less circular than at Strawberry Island. As in the case of BN-6, this disparity may be due to the smaller series from the Chief Joseph Reservoir. The tendency toward regular circles of the FR-5 pits seems to be much less common in the lower NcNary sites where roughly 30% of the 148 house pits recorded from the two sites are more than 20% longer in one diameter, are more oval. This tendency, although present, was not nearly as strong at Strawberry Island.

In summary, there has been noted a tendency toward larger, more circular houses as one goes north in the McNary Reservoir up the Columbia and Snake Rivers. Outside of the Chief Joseph Reservoir no data exist for house pits in the more northerly parts of the Plateau, except in ethnographic sources. Those presented by Ray indicate that the larger pits, which measure more than 22 feet in the maximum diameter, are associated with the Canadian Plateau, whereas the pits with a maximum of 20 feet or less are more often associated with the American Plateau. The minimum diameter for the house pits, according to Ray, is between 10 and 16 feet for both areas. **(Ray, 1942, p. 177).** These data are for the so-called circular type of semi-subterranean house, which is reported for all of the Plateau except the Umatilla,Kutenai, Flathead and Coeur d'Alene. It is probably safe to say that the information for the Umatilla is incomplete, in view of the occurrence of house pit sites with historic horizons in areas which were occupied by the Umatilla in historic times. Ray's data also indicate that the true semi-subterranean houses of the Tenino and Klikitat were excavated to depth of approximately 10 or 8 feet, whereas in the rest of the Plateau (according to available information), pit houses were usually excavated to a depth of 4 or 5 feet. Ray suggests that the information for the Klikitat and Tenino is questionable, **(Ibid,** p. 256) and the archaeological records seem to bear him out. Surface indications suggest that the house pits in the lower McNary Reservoir were indeed rather shallow, and this too is borne out by the excavations. It appears that this same situation prevails in the Upper McNary Reservoir. Data concerning the superstructures and entranceways of the McNary Reservoir house pits are completely lacking; this is true, archaeologically, of the Plateau as a

whole. It has also been pointed out elsewhere that the scarcity of good timber for beams led the people of the southern Plateau to preserve them rather carefully by removing them when the house was to be unoccupied for any length of time. This no doubt accounts for the lack of definite data on superstructures. Thus the most specific data that can be offered at this writing are that throughout an unknown perior of time the house pits in the lower McNary Reservoir have tended to be smaller than those upriver. It has been noted that there seems to be a tendency toward larger house pits as one goes north toward the northern Plateau in more recent times.

THE ARTIFACTS

The individual artifact recovery at FR-5 was meager indeed. There follows a census of the artifacts, other than the survey surface collection:

TABLE 2.

Location	Number of pieces	Description
Surface	23	Hammerstones, Choppers, broken Pestles, etc.
HP 1	5	Scrapers, sinker, maul handle
HP 2	13	Projectile points, knife, hammer or pecking stones
HP 59	2	Projectile point, scraper
HP 78	6	Chopper, drill, net, sinkers, Worked bone, hammer
HP 87	5	Projectile points, worked flake

The 54 artifacts found can obviously be no cross-section or adequate sample of even their own types. We shall therefore do no more than describe them.

None of the artifacts was in any way unusual for the Plateau, although some of the projectile points had not previously been associated with house pits. The artifacts have been spotted on the profiles where they are marked with an "x". The major share came from the living zones of the house pits, i.e., the levels which contained the greatest amounts of organic material.

Fig. 7 illustrates typical and outstanding pieces where they are designated by their catalog numbers. Thus the andesite pestle in the upper right of fig. 7a is 45-FR-5/House pit 2/artifact 9. The chopper next to it had no association, etc. Artifact 2/9 and 78/5 (a piece found on the surface) saw use as hammers. The first may have been a pestle in the process of making; 78/5 is a basalt cobble - well battered from much use. Item /12 is an elongate diorite cobble with one end percussion-fractured to a crude, sharp, uneven edge. Such rough-edged tools for scraping or chopping appear in great numbers up and down the Columbia Valley. Often they are made of oval or rounded, rather than elongate, cobbles. Number 1/3 is an example of this. It is a flat, igneous, probably andesite, cobble. Both ends have been percussion-chipped, with a double bevel; it would serve equally well as a chopping or coarse scraping tool. The basalt knife /14a, from the surfafce, is of a type which appears to be associated with older strata of the typical Columbia Valley culture. Fig. 7b illustrates the smaller artifacts: 2/14 is an oval jasper flake, pressure-chipped into a small point. Such oval points are rare in the area. This one has a thinned base; no evidence of its hafting is visible. The tiny point 2/17 is unusual as far as size is concerned although 1 to 5% will occur on most sites. The large chalcedony point, 2/11, has a slightly expanding stem; otherwise it is of the same outline. Another jasper point of this form came from house pit 87. Item 78/7 is carved bone - possibly part of a comb; 78/2 is a drill, a not unusual piece; 2/10 (jasper) and 2/18 (chalcedony) were part of a small cache of 9 points. Three were of the type with side (neck-stemmed) notches and an expanded wide notched base (fig. 7b, 2/10 and 2/18) and 5, like 2/19 (jasper) and 2/13 (chalcedony), had simple expanding stems and corner notches. The workmanship of both types is superb; the blades long and thin. Item 2/17, already discussed, was the ninth point in the cache.

Animal Bone

Assistance from the Smithsonian Institution and the University of Washington has made possibile the identification of our mammalian, fish and shellfish remains. From 45-FR-5 came 48 antelope bones, 31 salmon bones, 86 jackrabbit bones, and a few other unimportant fragments. The most interesting aspect of these ecologic data is the antelope bone series. Antelope have not been previously recorded, although they have been suspected as having inhabited the area. Further and synthetic data on animal distribution in the Plateau, derived from a study of the bones found archaeologically, may be found in Osborne (1953). Shellfish used were of the kinds presently in the area.

SUMMARY

This enormous house-pit site was sampled; we can only hope adequately. It is fortunate that the higher parts of Strawberry Island will be above water level of the McNary Pool. They may withstand erosion for some time and thus be available for further work for a few years. The site is, as far as our information goes, precontact. No objects of European origin were found. The types of artifacts found in the excavated houses are of types known from late prehistoric sites. It is probable that the earlier house pits would have been obliterated by later pit digging so a fairly extensive excavation program would be necessary to work out cultural stratigraphy. The pro-

pinquinty of the various pits would indicate that occupation was scattered and that not all or even a large percentage of the pits were dwelling places at one time. House pits were probably dug anew or cleared and dug out by each dwelling group, probably each family, rather frequently. The soil is friable and a pit soon loses its shape, becomes enlarged by bank slumping and erosion. It would often be a problem of new timbers or a new house pit - the latter was by far the simpler solution.

GOAT ISLAND, 45-BN-16

This site, see inset, fig. 1, was located by the survey crew as being, primarily, on the southern, down-stream end of Goat Island. Here there is an area of exposed sand and dunes, the result of aeolian and fluvial action, where skeletal material, hearths and chipped stone are exposed. Hearth or earth oven remains, areas of broken shell, and midden exposures were found and explored by the excavating crew on up both sides of the island for about two-thirds of its length. The midden exposures were best on the eastern side.

Indications available to the survey team pointed toward the Goat Island site as an excellent one for excavation. Hearths and areas of fire-cracked rock, evidences of chipping and some outcroppings of midden strata led these men, and the members of the excavating crew, to an overestimation of its archaeologic possibilities. Digging at this site never progressed beyond the testing or exploratory stage. Test pits were dug; banks were sheared off or profiled.

The Midden

Tests and clearing activities on the island, principally on the east coast, revealed an interesting and long sequence of shallow midden deposits. Several dark, heavily organic strata with interbeddings of well-packed sand or loam were the usual types of deposits encountered. Fig. 8, C, illustrates a typical situation. These stratigraphic columns, excellent as they were from a stratigraphic point of view, were almost useless archaeologically. There were so few artifacts found that no interpretations can be based upon the collection.

A typical column is, from the surface down: loose sand, grass roots, etc., 1 foot; hard packed sandy loam, 2 feet; a stratum of heavy organic earth, charcoal, sand, 5 inches; sandy loam, 1 foot; charcoal and shells, 6 inches; gravelly sandy loam, 8 inches; burned rock, sand, charcoal, organic material, etc. 8 inches to 1 foot; hard packed sand and loam, 7 inches; charcoal and ash lenses about 2 inches thick in a sandy and gravel stratum, 10 inches thick; beach pebble in yellow sand - the subsoil. It is unfortunate that neither the time nor the money were available to trench inland, perpendicular to the coast, from the cut bank. Work of this nature would have yielded information on deposit building in an occupied area, information which we do not have, but the tests give no hope for finds in sufficient quantity for detailed cultural interpretation.

The Stone Hearths

Stone remains of earth ovens or cooking areas are a usual aspect of Plateau archeology. In the lower parts of the McNary Reservoir, the section of the river from Walla Walla to Umatilla, the hearths were rather ragged areas of burned and fire-cracked rock, charcoal and ash and, often, the shells of river mussels. In aboriginal times the earth ovens were usually made and used in the following manner: An excavation was made and lined or filled with rocks or a small unexcavated area was floored with rocks. Upon these a fire was built and the fire allowed to burn down to a bed of coals which heated the stones. These were then cleaned or swept, covered with clean vegetation or bark. Upon this was placed the food to be cooked. The food was covered with grass or leaves and then with earth to seal in the heat. A steam oven type of cookery; similar to that of Polynesia, was the result. Attenuated or full-fledged forms of this type of oven are perhaps the single most numerous sub-surface cultural manifestation in Plateau archaeology.

Along the shores of Goat Island the rock concentrations varied from the norm of the lower McNary Reservoir area in that they were unusually and carefully made. Fig. 8 illustrates the two types found at BN-16. It will be noted that they are outlined with larger, up-ended cobbles as far as the larger ovens are concerned (fig 8, a, c, d), and that the smaller (fig. 8, b) are made up of carefully arranged cobbles set so that the individual stones point in and down with the result that the whole stone flooring has a dished shape. It is not known now what the distributions and cultural significance of these slightly different cooking conventions are.

The hearths were noted particularly on the east and west banks where they had been exposed by erosion (particularly on the western bank). Others were found on the surface or by excavation on the eastern bank at depths of 4½ feet below the top of adjacent cut banks. It cannot be stated catagorically that our two types have functional significance. It is possible that the first type, and the usual one met with in Plateau excavations, is merely a destroyed, spread out, much used cooking area (fig. 8, c). If this is so our second type, smaller and neatly basined with igneous cobbles on end and side and with fire remains and cracked rock confined to the central

sections, may well represent the preliminary construction of earth ovens or relatively unused units. It is equally possible that a temporal or cultural (perhaps the preparation of different foods) difference is represented by the markedly different remains. The suggestion that the two types are simply extremes of the same functional form is somewhat borne out by the fact that the larger ovens (diameters: Feature 1, 10 feet x 9 feet (fig. 8, d); F. 4, 6 x 6½ feet (fig. 8, c); F. 6, 8½ x 8 2/3 feet) were all primarily composed of fire-cracked fragments of rock and the cobble outlines were partly inconsistent and broken. On the other hand, the smaller ovens, our second type, (F. 2, 5 x 6 feet; F. 3, 3½ x 4 feet (fig. 8, b); F. 5, 4½ x 5 feet (fig. 8, a); F. 7, 3½ x 3½ feet) were all neatly outlined, basined and floored by whole or nearly whole river-rounded cobbles. Thus a continuum appears to exist from Features 5 or 3 to the common oven of the Plateau, a large area of fire-cracked rock. Be this as it may, Goat Island ovens are different and, even if the ones excavated fit into the Plateau oven-continuum as a whole, they are unusual and must reflect some local peculiarity. Future excavators should bear this in mind and watch for better cultural association than we were able to secure. Ray **(1942, p. 134 seq.)** does not list variants of the earth oven although he shows it as essentially a Plateau-wide trait ethnographically.

The Burial

One burial was found near the southern point of the island. It was nearly wholly weathered out of its original grave. The skeleton lay on the surface of the ground, undisturbed as the spring flood and later winds had cleared it. No evidence of other burials was found in the area. Probably they were there, as well as elsewhere on the island, but such surface alterations as the original sextons may have made have long since vanished. Search for a cemetery under such circumstances would be absurdly expensive.

Burial 45-BN-16/1 lay on the right side, head to the northeast, face to the southwest, arms folded in front, legs folded so that the femora made about a 90° angle with the vertebral column, in the semi-flexed position. The preservation was fair; the individual an adult female. A single projectile point was with the burial; it lay within the lower rib cage. It might well have been intrusive and the cause of death. This point is illustrated, fig. 9, a, and discussed in the following section.

The Artifacts

Of the 42 artifacts found only three were **in situ** finds; the point with burial 1 45-BN-16/B1 /1 (fig. 9, a); a net shuttle (fig. 9, b,/12) found 3.8 feet from the surface about 2 feet back from the bank in the second midden level (see fig. 8, b for a similar profile); a basalt digging tool (?), /10, fig. 9, b. All other artifacts were on the surface.

The shuttle, 9⅛" long, ⅜" wide, 3/16" thick is made of heavy bone, slightly decayed on one side but otherwise in excellent condition. The type is wholly aboriginal; it is the two-ended shuttle of the New World. This is an interesting find from the point of view of distribution. It indicates that the archaeological Plateau utilized a type of netting shuttle that has been recorded and collected from the Eskimo at least to California. It also, obviously, indicates that sophisticated fishing techniques were practiced locally. The heavy basalt digging tool is not a rare tool along the Columbia. Examples have been found in the lower McNary. Fig. 9, b, /225 is a fragment of a long basalt knife or point; it is illustrated, even though fragmentary, because of the interesting problem of the basalt chipped tools along the Middle Columbia.[4] The circumferentially chipped basalt cobble, fig 9, b, /20 is typical of the "throwing stones" (really scraping and chopping tools) found so often along the lower parts of the Columbia. Two objects of the type of /120, illustrated fig. 9, b, were found. They are feldspathic porphery cobbles, chipped to a roughly rectangular shape, and the chipped edges battered smooth. Osborne has previously interpreted them as a type of net sinker (1957, p. 48). They are called fish scalers by local collectors. The last item in fig. 9, b, is /16, a fragment of an antler wedge - a typical Plateau tool.

Smaller chipped artifacts are illustrated in fig. 9, a. All but B1/1 were surface finds. Six types of projectile points appear to exist here. The first column (/345, /325, /295, /375) and the two lower points of the second column (/386, /225) are of one group; roughly straight or slightly cornered notches, a rounded, expanding base, moderate width and length characterize them. The last point mentioned, with its decided corner notch and incurving sides is perhaps a typical. A second group, or subgroup, is represented by the point found with the burial (B1/1). Its notches are more basal; its stem straight sided and square cut. A third has a pointed oval outline, a rounded base and smoothly curving sides (/235, /385, /315). The fourth grouping, represented by a single obsidian point, (/18) is side notched; the stem is expanding; the base incurved. The fifth, (/285), also a single obsidian point or knife, is a bi-pointed oval. It is 1¾" long. The sixth (/245), opal, is broken. It was side notched and may have been a long, slender version of the fourth group. Item /25a is a quartzite scraper-plane. The last two pieces, (14, a, b), a light shale or talc, appear to be part of an unusual ornament.

[4] Recognized in 1948 and perhaps illuminated by Butler, 1961.

BIBLIOGRAPHY

Butler, B. Robert
1961 The Old Cordilleran Culture in the Pacific Northwest. **Occasional Papers of the Idaho State College Museum,** No. 5, Pocatello.

Collier, Donald; A. E. Hudson and Arlo Ford
1942 Archaeology of the Upper Columbia Region. **University of Washington Publications in Anthropology.** V. 9, No. 1.

Daugherty, Richard D.
1952 Archaeological Investigations in O'Sullivan Reservoir, Grant County, Washington. **American Antiquity** Vol. 17, No. 4, pp. 374-383, Salt Lake City.

Osborne, Douglas
1949 The Archaeological Investigations of Two Sites in the NcNary Reservoir, Washington. Columbia Basin Project, River Basin Survey, Smithsonian Institution. Mimeographed.

1953 Archaeological Accurrences of Prognhorn Antelope, Bison, and Horse in the Columbia Plateau. **The Scientific Monthly,** vol. 77, No. 5.

1957 Excavations in the McNary Reservoir Basin, near Umatilla, Oregon. **Bureau of American Ethnology,** Bulletin 166, U.S. Government Printing Office.

Osborne, Douglas and Joel Shiner
1951 The 1950 Excavations in Two McNary Reservoir Sites, Washington and Oregon. Columbia Basin Project, River Basin Survey-Smithsonian Institution. Mimeographed.

Osborne, Douglas, Robert Crabtree and Alan Bryan
1952 Archaelogical Investigations in the Chief Joseph Reservoir. **American Antiquity,** Vol. 17, No. 4, pp. 360-373.

Ray, Verne F.
1942 Culture Element Distributions. XXI, Plateau: **Anthropological Records,** 8:2, Berkeley.

Shiner, Joel
1952 Archaeology of 45-BN-6 **American Antiquity,** Vol. 17, No. 4.

Strong, W. D., Egbert Schenck and Julian H. Steward
1930 Archaeology of The Dalles-Deschutes Region. **University of California Publications in American Archaeology and Ethnology,** Vol. 29, No. 1.

Thwaites, R. Y. (Editor)
1904 **The Original Journals of the Lewis and Clark Expedition, 1804-1806.** New York: Dodd, Mead and Co., 8 Vols.

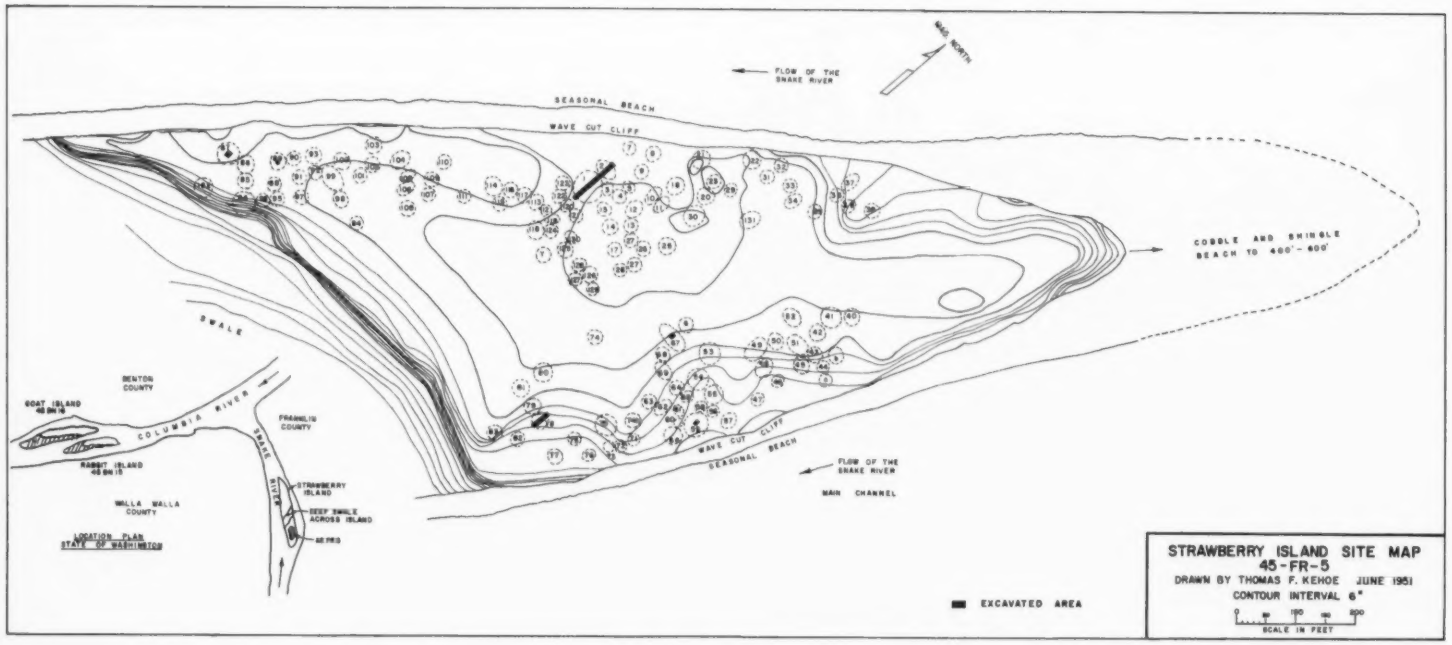
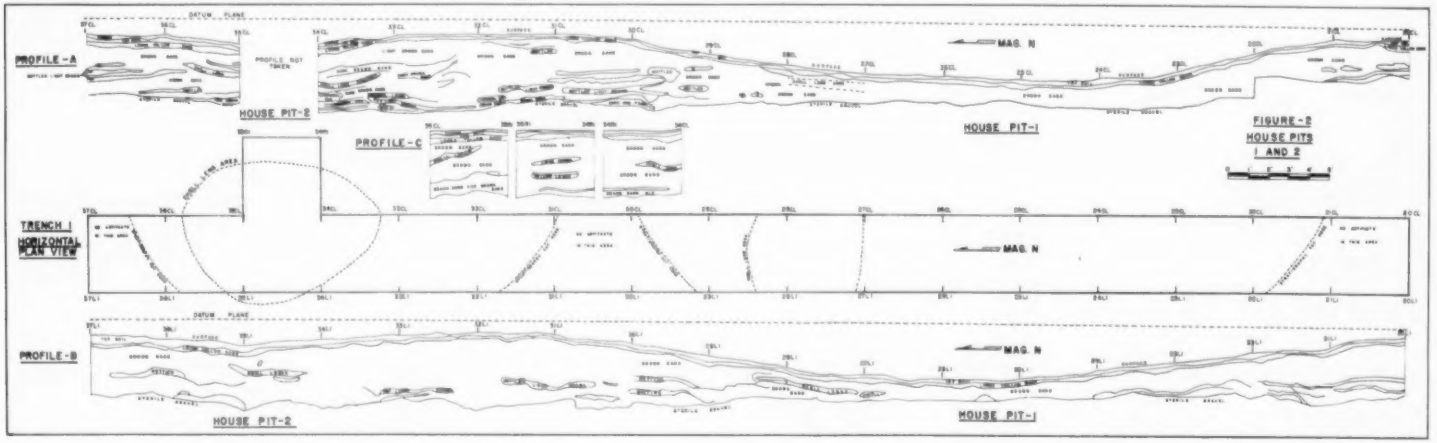
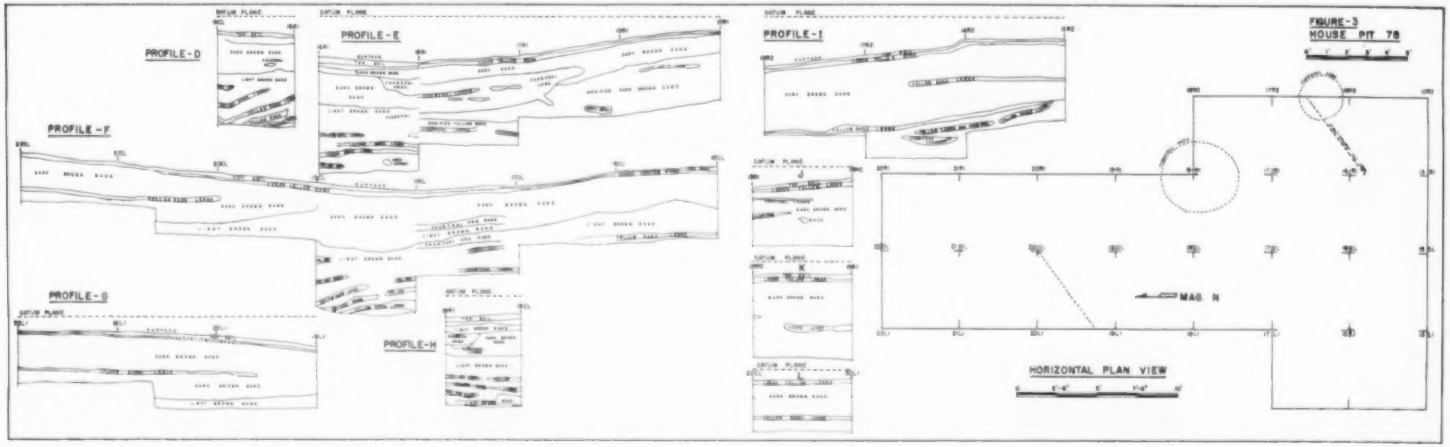
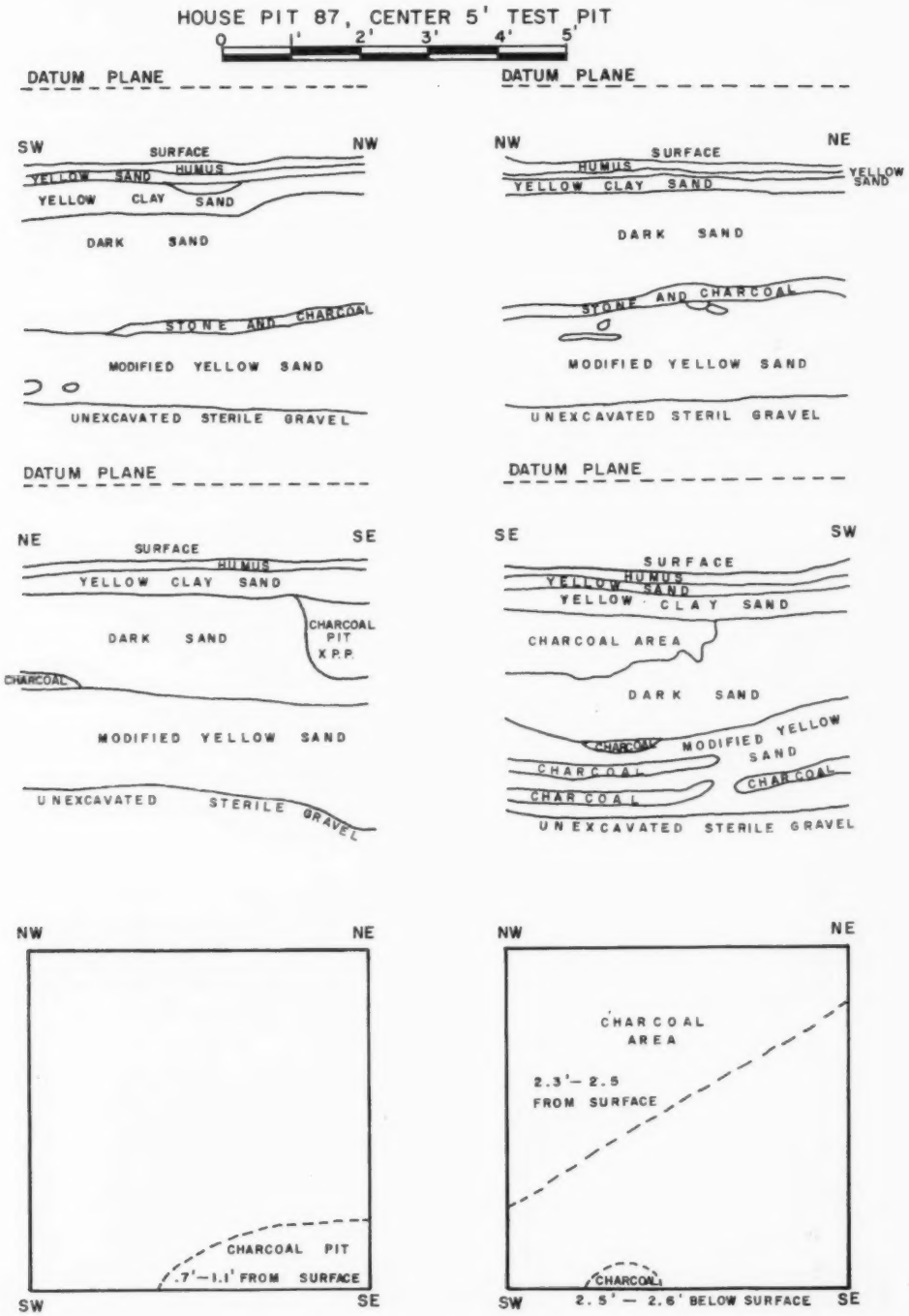

MAG NORTH
FLOW OF THE SNAKE RIVER
SEASONAL BEACH
WAVE CUT CLIFF
COBBLE AND SHINGLE BEACH TO 400' - 600'
SWALE
BENTON COUNTY
GOAT ISLAND 45 BN 16
COLUMBIA RIVER
FRANKLIN COUNTY
SNAKE RIVER
RABBIT ISLAND 45 BN 15
STRAWBERRY ISLAND
DEEP SWALE ACROSS ISLAND
45 FR 5
WALLA WALLA COUNTY
LOCATION PLAN STATE OF WASHINGTON
WAVE CUT CLIFF
SEASONAL BEACH
FLOW OF THE SNAKE RIVER
MAIN CHANNEL
EXCAVATED AREA
STRAWBERRY ISLAND SITE MAP
45-FR-5
DRAWN BY THOMAS F. KEHOE JUNE 1951
CONTOUR INTERVAL 6'
SCALE IN FEET

FIGURE 1

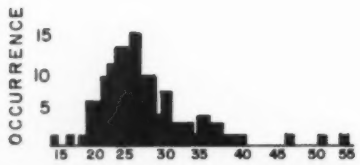

PROFILE-A
HOUSE PIT-2
PROFILE-C
MAG. N
HOUSE PIT-1
FIGURE-2
HOUSE PITS
1 AND 2
TRENCH 1
HORIZONTAL
PLAN VIEW
MAG. N
PROFILE-B
MAG. N
HOUSE PIT-2
HOUSE PIT-1


PROFILE-D
PROFILE-E
PROFILE-I
FIGURE-3
HOUSE PIT 78
PROFILE-F
PROFILE-G
PROFILE-H
MAG. N
HORIZONTAL PLAN VIEW



HORIZONTAL PLAN VIEW

FIGURE 4

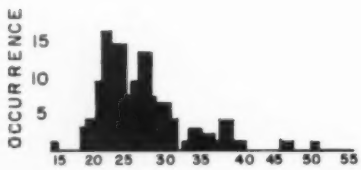


WIDTH, N-S, IN FEET

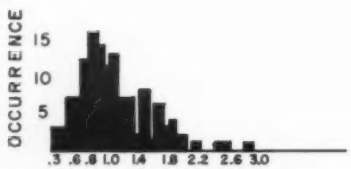
15% ARE MORE THAN 20% LONGER IN ONE DIRECTION.

45 FR 5

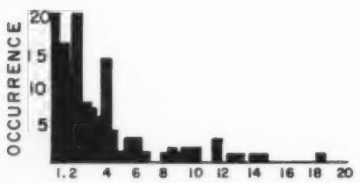
NUMBER OF HOUSEPITS:	130
MEAN NORTH - SOUTH:	27.06
AVERAGE NORTH - SOUTH:	27.48
MEAN EAST-WEST:	26.43
AVERAGE EAST - WEST:	26.7
MEAN DEPTH:	1.078
AVERAGE DEPTH:	1.07



WIDTH, E-W, IN FEET

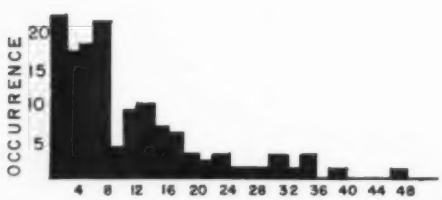


DEPTH IN FEET



DIFFERENCE OF DIAMETERS

RANGE: 0.0 FT. - 18.4 FT.
67, OR 51.5% HAVE LESS THAN 2.0 FT. DIFFERENCE
102 OR 78.4 % HAVE LESS THAN 4.0 FT. DIFFERENCE
MEAN DIFFERENCE 3.4 FT.



PERCENTAGE OF THE DIFFERENCE OF THE DIAMETERS

RANGE 0.0 % - 48%
74 OR 56.9 % HAVE A DIFFERENCE OF LESS THAN 8 %
MEAN PERCENTAGE OF DIFFERENCE 11.24 %

FIGURE 5

a

b

c

FIGURE 6: 45-FR-5 (a) Housepits 1 (foreground) and 2 (background), cross trench staked, to the south. (b) Excavating the same trench, to the south. (c) Digging in House pit 78.

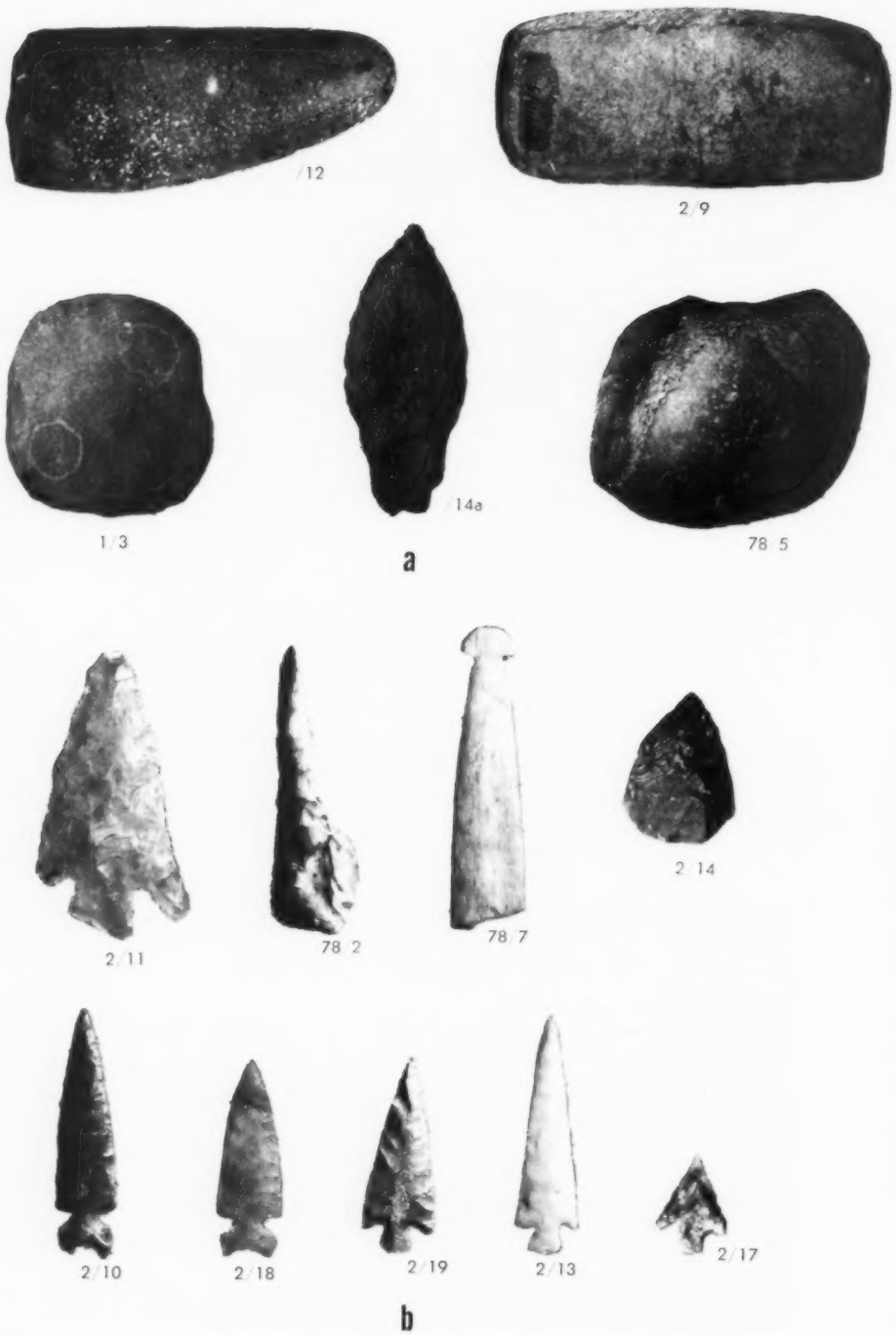


FIGURE 7: 45-FR-5 (a) Heavy artifacts, choppers and scrapers /14, a, is 4½" long. (b) Points and object, 2/10 is 1⅝" long. Numbers on all objects in plates are catalog numbers.

a

b

c

d

FIGURE 8: (a) Feature 5, 45BN16, to south. A rock hearth or oven on the west side of Goat Island. (b) Feature 3 to south, a rock hearth. (c) A rock hearth, feature 4, and profile, Test pit 3, northeast coast of island. (d) Outline rocks of a large hearth partially uncovered on the northeast of Goat Island; feature 1.

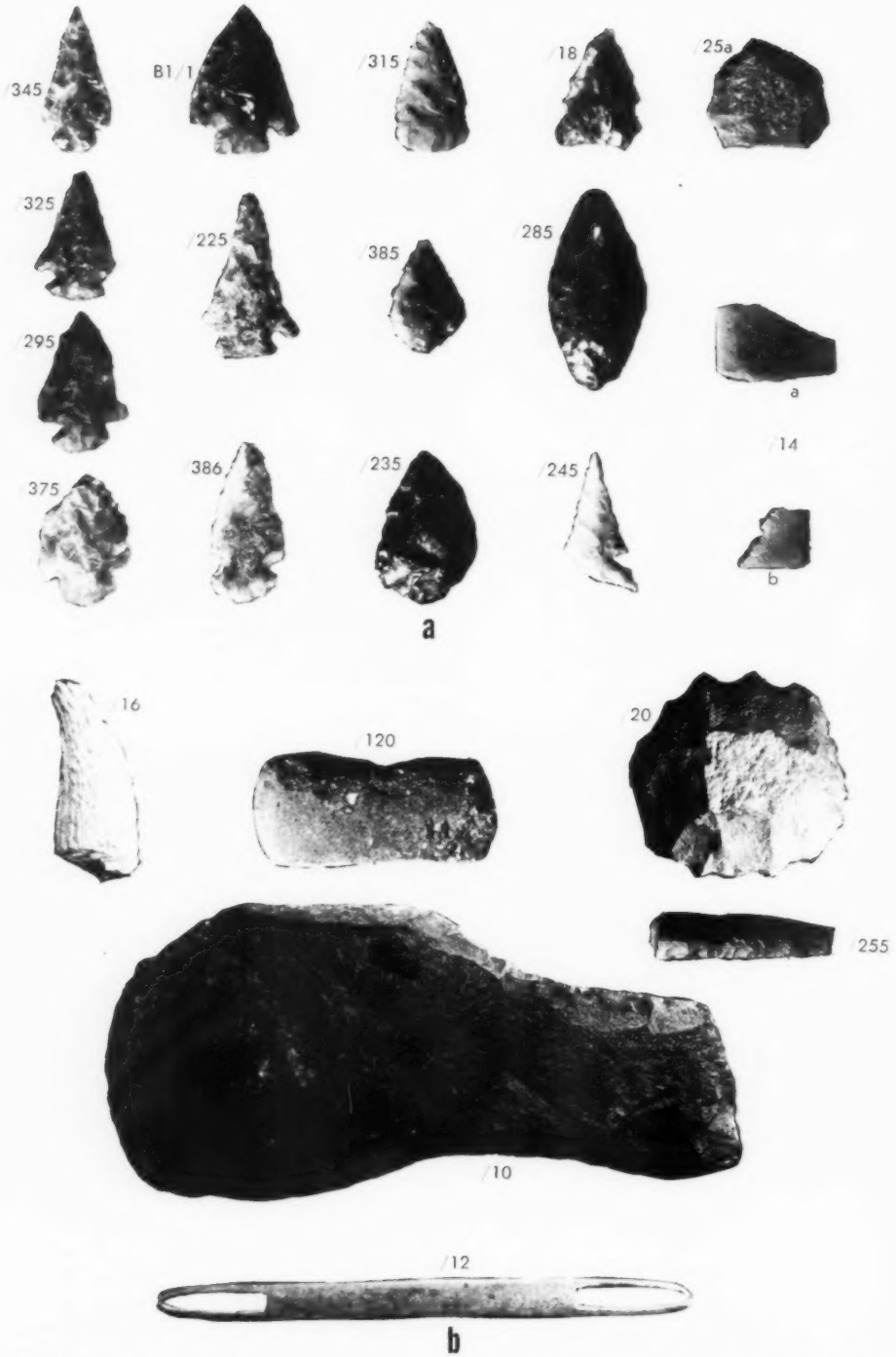


FIGURE 9: 45BN16 (a) Chipped stone implements, 45BN16, /225 is 1 1/16" long. (b) Large stone and bone implements, netting shuttle 9" long.

Notes on Material From a Burial Along the Snake River in Southwest Idaho

by Ruth Gruhn

INTRODUCTION

This paper describes a skull and artifacts recovered from a burial found anlong the Snake River in Canyon County, southwest Idaho. The burial site was located along the north shore of the river 3 miles southwest of the small town of Melba, near the old Murphy railroad bridge, which would place it in Section 18 or 19, Township 1 S (Boise Baseline), Range 2 W (Boise Meridian).

The burial was descovered by Mr. James H. Manning of Boise Idaho in August, 1960. At the base of a high rimrock on the north bank of the river he found a row of graves, some uncovered. Upon investigating one of these burials, he observed that the body was flexed on the right side, and facing to the east, towards the cliff. From this burial he collected the skull, a large fragment of coiled basketry, and several stone and wood artifacts. The skull and basketry fragment were given to Donald R. Tuohy of the Idaho State College Museum in September 1958; and the remainder of the artifacts, with the exception of an obsidian core which could not be located, were presented to the ISC Museum on 16 May 1960.

ARTIFACTS

Fragment of basketry

The material of the basket is apparently willow (*Salix*). The technique is evidently two-rod stacked foundation, non-interlocking stitch. The coiling is close: the diameter of the coils is ⅜ inch, and there are 7 stiches per inch. The fragment is incomplete at both top and bottom, and the diameter of the basket was evidently greater than 20 inches. It appears that the basket was a large shallow tray.

Close coiled basketry of two-rod stacked foundation, non-interlocking stitch, is apparently found among Paiute, Ute, and Shoshoni groups (Kelly 1932:121; Jennings 1957:248-249). According to Weltfish (1930:470) it occurs in the basketry of the Bannock and Shoshoni; and Lowie (1909:178) also noted the technique among the Northern Shoshoni.

Crude Scraper

This chipped stone artifact is large and ovoid in outline, with a thick butt and irregular cross-section. The technique is rough bifacial percussion flaking, with some secondary retouch on the edges. A portion of the cortex remains on the butt. The artifact is 6.4 cm. long, 5.1 cm. in maximum width, and 2.5 cm. in maximum thickness. The material is black ignimbrite.

Hafted stone point (Fig. 1)

This artifact consists of a small leafshaped stone point, of buff-colored chalcedony, hafted in a short, slender segment of golden currant wood (*Ribes auteum*). The total length of the object is 9.8 cm. The stone point is 2.8 cm. long, 1.3 cm. in maximum width, and 0.5 cm. in maximum thickness. The point is inserted, by its narrow end, in the split end of the wooden shaft; and is secured by some sort of glue and a close binding of fine S twist cord of vegetable fiber which probably originally extended to within 1.3 cm. of the end of the stone point. This cord wrapping appears to be coated with some hard dark-colored substance. The cord wrapping extended an indeterminate distance, but at least 1.5 cm., down the shaft. The total length of the shaft is 8.2 cm., the average diameter 0.9 cm. The opposite end of the shaft, which has a round hole or socket about 0.3 cm. deep, also exhibits traces of a close wrapping of fine S twist cordage extending for a distance of at least 3.8 cm. up the shaft.

This artifact appears to be the foreshaft of a bunt or stunning arrow. It is interesting to note that the sharper narrow end of the stone point is the part which was enclosed in the haft.

Wooden cylinder

This artifact is a long thick cylinder of willow (*Salix*) wood with both ends cut vertically blunt by short strokes. The sides have been shaved smooth and convex. The object is 17.4 cm. long and 2.3 cm. in diameter. Its use is unknown: it may be a baton for percussion flaking.

PHYSICAL ANTHROPOLOGY

OBSERVATIONS ON SKULL

1. general description ♀ cranium; good condition; sex criteria certain (male); medium muscularity
2. age - young adult
3. deformation - absent
4. form of vault
   norma verticalis - medium ovoid

5. frontal region
   - browridges - divided
   - browridge size - large
   - glabella - medium
   - frontal height - medium
   - frontal slope - medium
   - postorbital constriction - medium
   - frontal bosses - small
   - frontal breadth - medium

6. parietal region
   - sagittal elevation - medium
   - postcoronal depression - small
   - parietal bosses - medium
   - parietal foramina - medium

7. temporal region
   - fullness - medium
   - mastoids - large
   - supramastoid crest - medium
   - sphenoid depression - small

8. occipital region
   - occipital curve - medium
   - inion - small
   - occipital torus -medium
   - shape of torus - ridge
   - lambdoid flattening - small
   - transverse suture - absent
   - median occipital fossa - medium
   - condyles elevation - large
   - basion - medium
   - styloids - absent

9. sutures
   - serration
     - lambdoid - pronounced
     - coronal - medium
     - sagittal - pronounced
   - external occlusion
     - coronal - open
     - sagittal - open
     - lambdoid - open
   - Wormian bones
     - lambdoid - none
     - tempero-occipital - one

10. pterion form
    - right - H
    - left - H

11. region of ear
    - glenoid fossa depth - medium
    - postglenoid process - small
    - tympanic plate - medium
    - auditory meatus - oval

12. pterygoid plates
    - external pterygoid plates - medium
    - internal pterygoid plates - medium

13. orbits
    - orbits shape - oblong
    - orbits inclination - small
    - lacrimo-ethmoid articulation - medium
    - suborbital fossa - slight

14. malars
    - os japonicum - absent
    - malars size - medium
    - lateral projection - medium
    - anterior projection - small

15. zygomatic process
    - thickness - medium

16. region of nose
    - nasion depression - absent
    - nasal root height - medium
    - nasal root breadth - medium
    - nasal bridge height - high
    - nasal bridge breadth - medium
    - nasal profile - concavo-convex
    - nasal sills - absent
    - nasal spine - large
    - subnasal grooves - absent

17. prognathism
    - mid-facial - slight
    - alveolar - slight
    - total prognathism - slight

18. alveolar border
    - absorption - none
    - preservation - good

19. palate
    - palate shape - parabolic
    - palate height - medium
    - palatine torus size - small
    - palatine torus form - ridge
    - direction of palatine transverse suture - transverse

20. mandible
    - size - medium
    - chin form - medium
    - chin projection - medium
    - alveolar prognathism - slight
    - genial tubercles - large
    - mylo-hyoid ridge - medium
    - gonial angles - medium eversion
    - mandibular torus - absent

21. teeth
    - tooth eruption - complete
    - teeth lost or damaged - antemortum none, postmortem 19
    - teeth wear - medium
    - teeth quality - good
    - teeth caries or abscesses - none
    - bite - slight under
    - crowding - absent
    - molar cusps - upper 4-4-3, lower 4-4-5

MEASUREMENTS ON SKULL

1. circumference of vault - 550 mm.
2. antero-posterior or sagittal arc - 290 mm.
3. transverse arc - 333 mm.
4. glabello-occipital length - 180 mm.
5. maximum with - 137 mm.
6. basion-bregma height - 134 mm.
7. mean thickness left parietal - 4 mm.
8. minimum frontal diameter - 88 mm.
9. auricular height - 103 mm.
10. frontal height - 73 mm.
11. bizygomatic diameter - 139 mm.
12. nasion-menton height - 115 mm.
13. nasion-prosthion height - 69 mm.
14. basion-nasion length - 103 mm.
15. basion-prosthion length - 103 mm.
16. nasal heighe - 48 mm.

17. nasal breadth - 22 mm.
18. orbital height - left 35 mm., right 36 mm.
19. orbital breadth - left 39 mm., right 40 mm.
20. nasalia-upper breadth - 11 mm.
21. nasalia-lower breadth - 16 mm.
22. interorbital breadth - 19 mm.
23. biorbital breadth - 97 mm.
24. mean diameter foramen magnum - 35 mm.
25. palate - external length - 50 mm.
26. palate - external breadth - 64 mm.
27. height of mandibular symphysis - 32 mm.
28. minimum breadth ascending ramus - left 39 mm., right 40 mm.
29. length of mandibular body - right 98 mm.
30. height of mandibular body - left 31 mm., right 32 mm.
31. thickness of mandibular body - left 13 mm., right 11 mm.
32. bigonial diameter - 106 mm.
33. teeth

FIG. 1 Hafted stone point. Overall length of point and haft is 9.8 cms.

lower

		I_1	I_2	C	PM_1	PM_2	M_1	M_2	M_3
right	length	X	X	X	X	X	10 mm.	11 mm.	9 mm.
	width						10 mm.	10 mm.	9 mm.
left	length	X	X	X	X	7 mm.	11 mm.	10 mm.	10 mm.
	width					8 mm.	10 mm.	9 mm.	9 mm.

upper

		I_1	I_2	C	PM_1	PM_2	M_1	M_2	M_3
right	length	X	X	X	X	6 mm.	9 mm.	X	7 mm.
	width					8 mm.	11 mm.		9 mm.
left	length	X	X	X	X	X	9 mm.	9 mm.	8 mm.
	width						11 mm.	9 mm.	9 mm.

INDICES OF SKULL

1. cranial index - 76
2. height/length - 74
3. height/breadth - 98
4. fronto/parietal - 64
5. auricular height/length - 57
6. cranial module - 150
7. facial - 83
8. upper facial - 49
9. cranio-facial - 101
10. nasal - 46
11. left orbital - 90
12. nasalia-transverse - 69
13. interorbital - 51
14. external palatal - 128
15. zygo-gonial - 76
16. fronto-gonial - 120
17. zygo-frontal - 63

BIBLIOGRAPHY

Jennings, Jesse D.
1957 Danger Cave. **Memoirs of the Society for American Archaeology** 14. Salt Lake City.

Kelly, Isabel T.
1932 Ethnography of the Suprise Valley Paiute. **University of California Publications in American Archaeology and Ethnology** vol. 31, no. 3, pp. 67-210. Berkeley.

Lowie, Robert H.
1909 The Northern Shoshone. **American Museum of Natural History Anthropological Papers** 2: 169-306. New York.

Weltfish, Gene
1930 Prehistoric North American Basketery Techniques and Modern Distributors. **American Anthropologist** 32: 454-495. Menasha.

NOTICE OF CONTRIBUTORS

EDSON FICHTER is Professor of Zoology at Idaho State College, and Curator of Mammalogy in the Museum. Much of his field research in recent years has been directed to the study of prong-horn antelope. He received his PHD from the University of Nebraska.

MARIE HOPKINS is Curator and Assistant Professor of Vertebrate Paleontology in the Idaho State College Museum. She is completing a study of *Bison Latifrons* with support from the National Science Foundation. Miss Hopkins has concentrated her work on Pleistocene vertebrates in Southeastern Idaho.

B. ROBERT BUTLER serves as Research Associate in Archaeology at the Museum. His current research includes supervision of field excavations on the Clearwater Plateau of North-Central Idaho. He has previously been a contributor to the pages of this journal.

DOUGLAS OSBORNE received his PHD from the University of California. At the present time, he is Director of the Wetherill Mesa Project for the National Park Service in Mesa Verde National Park, Colorado. Doctor Osborne has worked extensively in several areas of Western American Prehistory.

ROBERT CRABTREE is a graduate student in anthropology at the University of California, Los Angeles. He received his B. A. and M. A. Degrees from the University of Washington and his primary field experience has been in the Pacific Northwest.

RUTH GRUHN is a post-doctoral fellow at the Institute of Archaeology, University of London under a grant from the National Science Foundation. She is a research associate of the Museum and has been a contributor to the pages of the Journal.